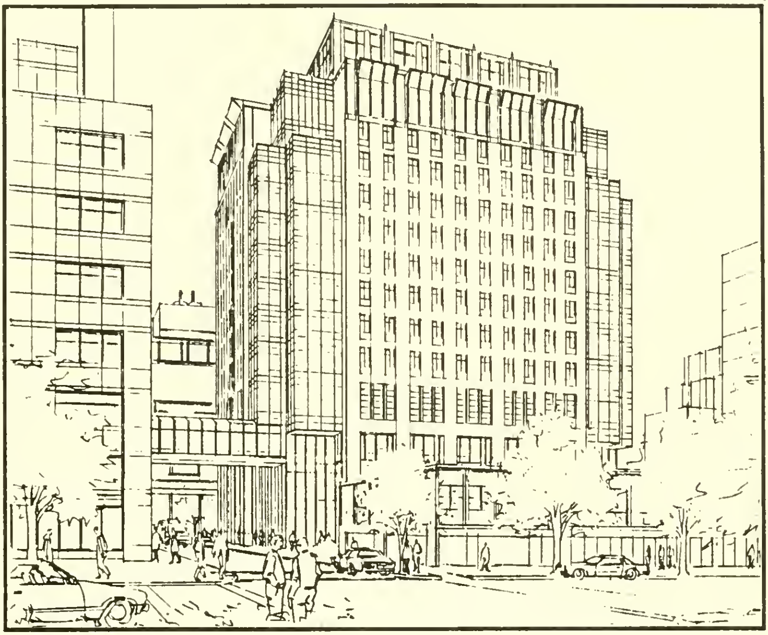
DANA-FARBER CANCER INSTITUTE
RICHARD A. AND SUSAN F. SMITH RESEARCH LABORATORIES
FINAL PROJECT IMPACT REPORT/
FINAL ENVIRONMENTAL IMPACT REPORT
EOEA #9452

May 16, 1994



Submitted To:

Boston Redevelopment Authority
City Hall
1 City Hall Square
Boston, Massachusetts 02201

and

Executive Office of Environmental Affairs
MEPA Unit
100 Cambridge Street
Boston, Massachusetts 02202

Submitted To:

DANA-FARBER
CANCER INSTITUTE
44 Binney Street
Boston, Massachusetts 02115

HMM Associates, Inc.
A Summit Company

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EXECUTIVE SUMMARY

DANA-FARBER
CANCER INSTITUTE

EXECUTIVE SUMMARY

I. FPIR/FEIR REQUIREMENTS

This Final Project Impact Report/Final Environmental Impact Report (FPIR/FEIR) is being submitted in response to the Preliminary Adequacy Determination (PAD) on the DPIR issued by the Boston Redevelopment Authority (BRA) on May 2, 1994 and the Certificate on the DEIR issued by the Executive Office of Environmental Affairs (EOEA) on December 16, 1993 (See Appendix A for copies of the PAD and Certificate).

The BRA's PAD requested additional information on a variety of issues including:

- Employment and public benefits.
- Trip generation and parking supply vs. demand.
- Effects of trip reduction measures on overall traffic conditions.
- Revised wind assessment based on design changes since the DPIR/DEIR.
- Revised shadow diagrams based on design changes since the DPIR/DEIR and additional shadow diagrams for October, November, December, January and February.
- Revised daylight analysis based on design changes since the DPIR/DEIR.
- Additional information on air quality, noise and geotechnical concerns.
- Information on the potential for recycling demolition and construction waste.
- Information on infrastructure demand vs. available capacities.

The Secretary's Certificate requested additional information, including:

- Status of overall Longwood Medical and Academic Area (LMA) planning efforts.
- Analysis of improvements in level of service expected with mitigation measures.
- Roadway improvements being considered by MASCO.
- Travel delays along major roadways, such as Brookline Avenue.

- Additional parking demand reduction strategies.

- Clarification of the basis for the trip generation presented in the DPIR/DEIR and a comparison of trip generation rates based on square footage vs. number of employees.

- Comparison of the Project's trip generation rates with these used by other LMA institutions.

- Long range needs and planning goals for the LMA.

2. RICHARD A. AND SUSAN F. SMITH RESEARCH LABORATORIES

The Dana-Farber Cancer Institute is committed to the elimination of cancer as a serious health problem in children and adults, through its programs in research, prevention, patient care, education and training. In addition to operating a cancer center in Boston, the Institute is a leader in the development and clinical application of cancer treatment methodologies and has been designated by the National Cancer Institute as a Comprehensive Cancer Center. To strengthen its mission to remain in the forefront of cancer research, the Institute must expand its facilities which are currently overcrowded.

Thus, Dana-Farber proposes to construct the Richard A. and Susan F. Smith Research Laboratories (the "Project") at 65 Deaconess Road in the Longwood Medical and Academic Area (LMA) of Boston (See Figure E-1). The Project has been modified and downsized from the proposed Project described in the DPIR/DEIR. The current proposal will add approximately 265,000 gsf* of space to satisfy Dana-Farber's research requirements by providing space for research, office, research support, and other accessory uses incidental to a research facility. The project will also provide a below-grade six-level, 246-space garage to better serve the Institute's parking needs.

This facility is important to the long term viability of the Institute. The new space will allow the Institute to attract the highest quality researchers and clinicians and continue to expand the programs which have led to advances in the diagnosis and treatment of cancer.

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* 213,592 gsf pursuant to the Floor Area Ratio (FAR) definition set forth in the Boston Zoning Code.

FIGURE E-1
SITE LOCUS MAP
SMITH RESEARCH LABORATORIES

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The location of the Project is a 28,845 square-foot site currently occupied by a small 3-story building used by the Institute and a 58-car surface parking lot. The site is situated across from the Institute's principal Dana Building, which is occupied by outpatient clinics, beds, research space, and administrative offices. The proposed Project program will establish a physical connecting link or overhead bridge at the third level to the Dana Building (and adjacent Mayer Building used for research) to facilitate the movement of researchers and physicians between facilities.

The Project is also across from the Jimmy Fund Building, which is one of the Institute's major research facilities. The existing second level overhead bridge diagonally connecting the Jimmy Fund Building and the Dana Building will be replaced by a new higher bridge at the third level connecting the Jimmy Fund Building to the Smith Research Laboratories.

As part of the Project, space will be provided for the research needs of Brigham and Women's Hospital (BWH), which is nearby on the opposite side of Binney Street. The Institute and BWH conduct complementary research, the results of which advance the work of each institution. BWH's research needs have also expanded dramatically and the close proximity of the two institutions promotes continued interaction between them.

The benefits to the City of Boston from such a Project are significant, including up to 420 new permanent jobs in the long-term and 150 to 200 construction jobs over a 3-year period; Development Impact Project contributions in accordance with Sections 26A and 26B of the Boston Zoning Code; establishment of a Boston Residents Construction Employment Plan and First Source Agreement for permanent employees; and other community benefits including those targeted to the nearby Mission Hill and Fenway areas.

The Project's design and building program has continually evolved during the past twelve months following discussions with the Boston Redevelopment Authority (BRA) and its urban design staff. The current design is for a building of 184 feet above-grade plus rooftop mechanical space. Corner setbacks at the top two floors will reduce the perceived mass of the building. The below-level garage will be accessed from Deaconess Road to link the garage more directly to Brookline Avenue and away from Binney Street. Bicycle racks will be provided adjacent to the garage entrance to encourage this form of transportation to the site. The Project's off-street loading docks will be located on Binney Street, and will include three bays enclosed within the first (street) level.

Since the filing of the Draft Project Impact Report/Draft Environmental Impact Report (DPIR/DEIR) in November 1993, Dana-Farber has made a number of design changes to the Project in response to community input and further review by the BRA and the Boston Civic Design Commission:

- The size of the proposed building has been reduced by one floor, thereby reducing the total building program by 24,728 square feet.
- The building height has been reduced from 194 feet to 184 feet.
- Total parking has been reduced from 261 to 246 spaces.
- The overhead bridge from the Project to Brigham and Women's Hospital has been eliminated.
- The existing bridge between the Jimmy Fund Building and the Dana Building will be replaced with a new bridge connecting the Jimmy Fund Building to the Project that better meets current City/BRA design standards.
- The resulting FAR for the revised Project is 7.4 (vs. 8.27 for the DPIR/DEIR Project) and as important, total combined FAR of the Project site with the Redstone Building site is now only slightly in excess of 5.0, reduced from an FAR of 5.7 with the DPIR/DEIR Project.

3. PUBLIC REVIEW PROCESS

The Project has been under review by the City since May 1993 when a Project Notification Form was submitted to the BRA. The State review commenced with the filing of an Environmental Notification Form in June 1993. A joint DPIR and DEIR was filed with the BRA and the Executive Office of Environmental Affairs (EOEA), respectively, on November 1, 1993 to satisfy both the City and State review requirements.

Community review of the Project's design and impacts has been ongoing with the Mission Hill Planning and Zoning Advisory Committee (PZAC). Project presentations took place on November 9, 1993 and on March 1, 1994. In addition, design review of the Project was completed by the Boston Civic Design Commission (BCDC) on March 8, 1994. During review with the BCDC, the Project architects attended five meetings to resolve design concerns. The BRA Board voted to approve the Project on March 10, 1994 (see Appendix B for a copy of the Memorandum).

This joint FPIR/FEIR is being filed to satisfy the additional data requirements outlined in the BRA's Preliminary Adequacy Determination on the DPIR and the Secretary's Certificate on the DEIR.

4. PROJECT SCHEDULE

The estimated construction schedule for the Smith Research Laboratories extends over a 36-month period. Demolition of the existing buildings and foundation construction is scheduled to begin in July 1994 and be completed by October 1995. Project occupancy is expected in July 1997.

I. GENERAL INFORMATION

DANA-FARBER
CANCER INSTITUTE

I. GENERAL INFORMATION

1.0 APPLICANT INFORMATION

1.1 Project Identification

Project Name:	Richard A. and Susan F. Smith Research Laboratories (formerly Dana-Farber Cancer Institute New Research Building)
MEPA Number:	The Executive Office of Environmental Affairs (EOEA) number assigned to the Project is 9452.
Location:	The Project site is located at 65 Deaconess Road in the Longwood Medical and Academic Area (LMA) of Boston, Massachusetts. The site is bounded by Deaconess Road, Binney Street, the Medical Area Total Energy Plant (MATEP), Dana-Farber's Redstone Building at 462-464 Brookline Avenue and Children's Hospital's 454 Brookline Avenue building and parking lot. Figure E-1 shows the general location of the Project.
Lot Size:	The site consists of 28,845 square feet of land (approximately 0.7 acres).

1.2 Development Team

Owner/Developer:	Dana-Farber, Inc. and Dana-Farber Cancer Institute, Inc. 44 Binney Street Boston, Massachusetts 02115 John W. Pettit Chief Administrative Officer Thomas McNamara Director of Support Services
Legal Counsel:	Brian S. Meyer, Esquire Associate General Counsel Dana-Farber Cancer Institute 44 Binney Street Boston, Massachusetts 02115

Architect:	Shepley Bulfinch Richardson and Abbott 40 Broad Street Boston, Massachusetts 02109 Lloyd Acton, AIA Oliver Egleston, AIA Malcolm Kent, AIA
Environmental and Transportation Consultant:	HMM Associates, Inc. 196 Baker Avenue Concord, Massachusetts 01742 Mitchell L. Fischman, AICP Jill H. Reynolds Barry Porter, AICP
Wind Consultant:	Frank Durgin, P.E. c/o Wright Brothers Wind Tunnel Massachusetts Institute of Technology Cambridge, Massachusetts 02139
Mechanical and Electrical Engineer:	Syska and Hennessy, Inc. 11 West 42nd Street New York, New York 10036 Mark Yakren
Structural Engineer:	Zaldastani Associates, Inc. 7 Water Street Boston, Massachusetts 02109 Alan Simon
Geotechnical Engineer:	GEI Consultants, Inc. 1021 Main Street Winchester, Massachusetts 01890 Frank Leathers

Construction Manager: Perini Building Company, Inc.
Prudential Center Boston
800 Boylston Street - Suite 550
Boston, MA 02199

Stephen A. Villani

1.3 Legal Information

1.3.1 Legal Actions Pending Concerning the Proposed Project

The Institute is not aware of any legal judgments or actions pending concerning the Project.

1.3.2 Evidence of Site Control Over the Project Area

The Project is proposed on property owned by Dana-Farber, Inc. and currently used by the Dana-Farber Cancer Institute, known as 65 Deaconess Road in Boston, Massachusetts. Dana-Farber, Inc. is the fee owner of the site.

1.3.3 Public Easements

There is one vehicular easement area in the southeast corner of the Project site. This easement provides access to the Medical Area Total Energy Plant (MATEP) facility.

2.0 FINANCIAL INFORMATION

The proponent is seeking financial assistance from the Health Educational Facilities Authority (HEFA) in order to construct this Project. Financial information for the Project is being developed for HEFA. When this information is completed, it will be provided to the BRA and MEPA, as appropriate.

Financial information for the Brigham and Women's Hospital (BWH) participation in the Smith Research Laboratories Project is based on a commitment to the space only at the present time. BWH will be assigned to two of the laboratory floors and one-half floor of the animal facilities. Dana-Farber will have a twenty-year lease after which time space occupied by BWH will be returned to Dana-Farber use.

3.0 PROJECT AREA

The site includes 28,845 square feet of land, located at the corner of Deaconess Road and Binney Street in Boston, Suffolk County, Massachusetts, known as and numbered 65 Deaconess Road. Figure 1.3-1 shows a survey plan prepared by Harry R. Feldman, Inc. Professional Land Surveyor, in September, 1993. The metes and bounds of the Project site are as follows:

- A certain parcel of land located in the City of Boston, Suffolk County, Commonwealth of Massachusetts, bounded and described as follows:
    - Beginning at the intersection of the southerly sideline of Deaconess Road with the westerly sideline of Binney Street and running S 38° 00' 54" W, along the westerly sideline of Binney Street a distance of 184.46 feet to point;
    - thence turning and running N 51° 59' 08" W, a distance of 155.80 feet to a point;
    - thence turning and running N 38° 00' 54" E, a distance of 84.13 feet to a point;
    - thence running N 36° 53' 59" E, a distance of 100.39 feet to a point on the southerly sideline of Deaconess Road;
    - thence turning and running S 51° 59' 37" E, along the southerly sideline of Deaconess Road a distance of 157.79 feet to a point of beginning.

4.0 PUBLIC BENEFITS

4.1 Payment In-Lieu of Taxes (P.I.L.O.T.)

Dana-Farber has reached agreement with City Assessors to make annual payments of $90,375 to the City as a payment in lieu of taxes, based on the Project's current size.

4.2 Development Impact Project Contribution

The Project constitutes a Development Impact Project (DIP), as that term is defined in Sections 26-26B of the Zoning Code. Dana-Farber will provide linkage contributions to the City of Boston, as applicable. These linkage contributions, will aid in the development of affordable housing and job training and will be made in accordance with the terms of a DIP Plan and Agreement entered into between the BRA and Dana-Farber. Dana-Farber

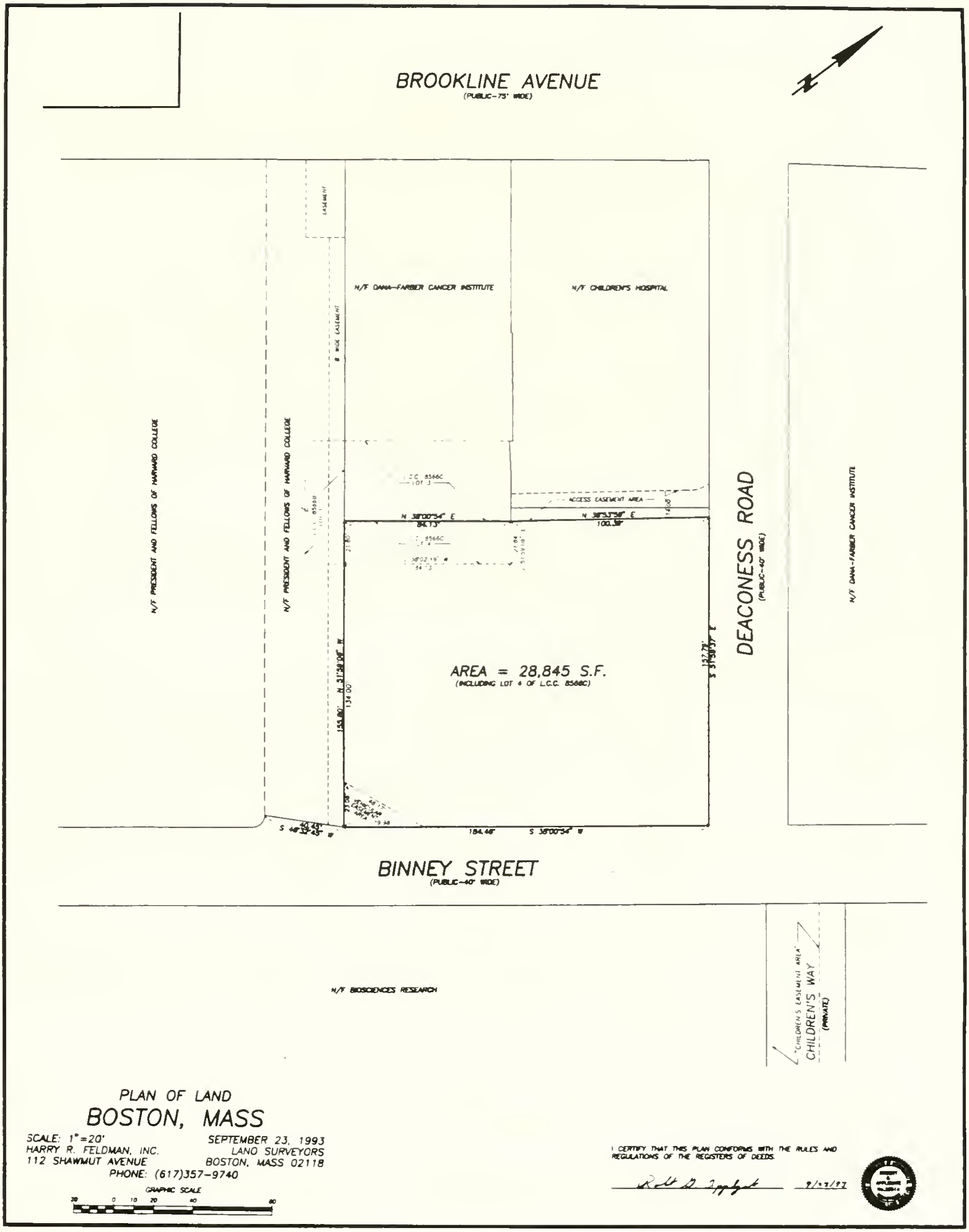

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FIGURE I.3-1
SITE SURVEY PLAN
SMITH RESEARCH LABORATORIES

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will provide linkage payments in the amount of $6.00 per square foot. This results in a total Housing Linkage contribution of $567,960, and a total Jobs Linkage contribution of $113,592, based on the Project's current size.

4.3 Anticipated Employment Levels

4.3.1 Construction Jobs

Temporary employment opportunities will be provided during construction phases of the Project, which will target Boston residents in accordance with a Residents Construction Employment Plan executed with the City. It is estimated that at the peak construction period, up to 200 construction workers may be employed. The construction period is expected to last approximately 36 months, from July 1994 to July 1997.

4.3.2 Permanent Jobs

The Institute expects that 420 new jobs may be created by the Project in the long-term. Recruitment of City residents will be in accordance with the First Source Agreement executed with the City.

4.4 Other Public Benefits

The Project will benefit the City of Boston by enhancing the expertise and reputation of the Institute by permitting growth. It will ensure the long term viability of the Institute and allow the Institute to continue as a provider of jobs and critical technology. The Project will also enable the Institute to attract the highest quality researchers and clinicians to continue and expand the research programs for which the Institute is well known. The contribution which the Institute makes to the community through improved diagnosis and treatment of cancer is immeasurable and widely recognized.

Biotechnology has been identified as one of the most important and economically significant technologies of the future. Both the City and State governments have indicated their interest in fostering the development of this technology.

Other public benefits are described below.

4.4.1 Neighborhood Health Care

Dana-Farber will support cancer education, prevention and screening through the neighborhood health centers.

4.4.2 Job Training and Permanent Employment

Dana-Farber currently employs 510 Boston residents, 22 of whom are residents of Mission Hill. The job classifications of Dana-Farber's existing Mission Hill employees are as follows:

Job Classification	Salary Range	No. of Employees
General Support	\$15,641 - \$30,451	6
Research Technicians	\$21,403 - \$41,267	4
Other Research Support	\$21,403 - \$104,000	6
Research Associate/Fellow/ Instructor (MD/PhD)	Negotiated	6
Total		**22**

Dana-Farber will continue to work with the local neighborhood residents to undertake the following initiatives:

- Dana-Farber is committed to working with local community and City agencies on a job creation plan for the local community that coordinates with other LMA employment and training plans using project job linkage funds.
- Dana-Farber will provide skills upgrading to current employees from the local community.
- Dana-Farber will make new job openings available to qualified community residents.
- Dana-Farber is committed to increasing the number of employees from the local community and working with the community to accomplish this.
- Dana-Farber's Director of Human Resources will coordinate training and recruitment.
- Dana-Farber will regularly distribute notices of available jobs to locations agreed to by the community.
- Dana-Farber is committed to working with other institutions and community groups to increase notice of available jobs.

- Dana-Farber will continue to participate in job fairs to publicize job openings.

- Dana-Farber will coordinate with Boston's existing job training programs to increase employees from the local neighborhood.

- Together with neighboring hospitals, Dana-Farber is developing a program to offer counseling sessions for potential employees.

- Dana-Farber will continue to use local community agencies, such as the Private Industry Council, for referrals for job opportunities and to increase the number of local residents in the job applicant pool at the Institute.

- Dana-Farber has submitted a Boston Residents Construction Employment Plan to meet the Boston Residents Job Policy for project construction jobs.

4.4.3 Neighborhood Residency

- Dana-Farber will participate in the LMA area Walk-to-Work program by:
    - Posting of pamphlets and materials about the local neighborhood;
    - Making information on housing in the local neighborhood available to its employees; and
    - Posting housing opportunities provided by the community on a bulletin board located at the Institute.

- Dana-Farber will keep a list of realtors, non-profit housing owners, apartment managers, and other property owners to help employees locate housing in the local neighborhood.

- Dana-Farber will make available to employees notice of housing opportunities in the local neighborhood.

4.4.4 Transportation

- Dana-Farber will continue to support MASCO's LMA-wide traffic mitigation programs and MASCO's lobbying effort to establish regional programs such as the circumferential transit, to bring relief to LMA traffic congestion.

- Dana-Farber has committed $45,000 to the City of Boston to assist in improvements to signals at and around the intersection of Brookline Avenue and Deaconess Road as part of a program to mitigate project impacts.

- Dana-Farber has a Commuter Mobility Plan in cooperation with MASCO and the Boston Transportation Department (through the Institute's Transportation Access Plan Agreement) which promotes and subsidizes ridesharing, and car and vanpooling opportunities.

4.4.5 Purchasing and Contracts

- Dana-Farber will encourage purchases from local businesses by using local business directories generated by the BRA, MASCO or the community.

- Dana-Farber, together with MASCO and other LMA institutions, will participate in an annual fair for small businesses, and will participate in workshops to introduce local vendors to the LMA institutions.

4.4.6 Progress Reports

- Dana-Farber will provide a biannual report of progress under the Cooperation Agreement approved for the Project. The reports will include the number of Institute employees from the local community.

4.4.7 Other Community Services

In addition to the above, Dana-Farber will continue to support the local neighborhood and the City. For example, the Institute:

- Supports neighborhood health centers;

- Participates in the LMA/Mission Hill/Fenway Food Project, providing emergency food and nutrition support to the local neighborhood;

- Supports Mission Hill Neighborhood Housing Services;

- Contributes to the Boston Committee on Access to Health Care (Mayor's Health Line);

- Makes unpaid internships available to college and high school students in laboratory, administrative, and clinical positions to provide work experience in laboratories.

5.0 REGULATORY CONTROLS AND PERMITS

5.1 Zoning Relief Required for the Project

At the time of submission of the DPIR/DEIR, the Project site was located within Boston's H-3 Zoning District. A summary of these zoning controls was contained in the DPIR/DEIR.

Subsequent to the filing of the DPIR/DEIR, new zoning controls for the site have been approved by the Boston Zoning Commission as set forth in Text Amendment No. 208 and Map Amendment No. 306 to the Zoning Code, which establishes a Dana-Farber Cancer Institute Institutional District based on Dana-Farber's approved Institutional Master Plan (see Appendix C for copies of the zoning text and map amendments). The Master Plan and zoning text amendments set forth the zoning controls applicable to the Project. The proposed uses of the site are also in conformity with the BRA's planning for institutional development within the LMA.

5.2 Regulatory Reviews and Anticipated Permits

5.2.1 City of Boston Article 31 Development Review

Although the Project does not fall under the BRA's jurisdiction for development review pursuant to Article 31 of the Boston Zoning Code, Dana-Farber voluntarily agreed to undergo the Article 31 review process. Dana-Farber submitted a Project Notification Form (PNF) for the Project to the BRA on May 17, 1993. A draft Institutional Master Plan was submitted to the BRA on August 4, 1993. Revisions to the Plan were submitted on September 24, 1993. A final Institutional Master Plan was approved by the BRA Board on March 10, 1994, and by the Zoning Commission on March 29, 1994.

The BRA issued a Scoping Determination for the Project on July 21, 1993 for preparation of a Draft Project Impact Report (DPIR). Dana-Farber submitted a joint DPIR/DEIR report on November 1, 1993 (see Section 5.2.2 for a discussion of the State review). The BRA's Preliminary Adequacy Determination (PAD) for the project was issued on May 2, 1994. A copy of this document is included in Appendix A. This FPIR/FEIR has been prepared in response to the BRA issued PAD and the MEPA Certificate described below.

5.2.2 Massachusetts Environmental Policy Act (MEPA) Review

An Environmental Notification Form (ENF) was submitted to the Executive Office of Environmental Affairs (EOEA) on June 1, 1993. A consultation session was held at the MEPA offices on June 30, 1993 to provide agencies and the public an opportunity to comment on the Project. On July 8, 1993 a Certificate on the ENF was issued by the Secretary of Environmental Affairs, requiring that an Environmental Impact Report (EIR) be prepared for the Project, pursuant to M.G.L. Chapter 30, Sections 61-62H and Sections 11.04 and 11.06 of the MEPA regulations (301 CMR 11.00).

A joint DPIR/DEIR was prepared and submitted to EOEA on November 1, 1993, in response to the Secretary's Certificate on the ENF. The Secretary issued a Certificate on the DEIR on December 16, 1993. A copy of the DEIR Certificate is contained in Appendix A.

As stated above, a single document, serving as a FPIR/FEIR has been prepared, to serve both the City and State review processes, in accordance with MEPA regulations. Responses to comments received on the DPIR/DEIR are included in Chapter IX of this report.

5.2.3 Anticipated Permits

Federal, State and local permits or other actions which have been or may be sought are listed below (please note that each permit will be filed unless further study shows that a particular permit is not required. Likewise, if further study reveals that additional permits are needed, appropriate filings will be prepared, as necessary):

Agency Name	**Anticipated Permit or Action**
FEDERAL	
Environmental Protection Agency	Pre-Asbestos Removal Notice NPDES Permit for Dewatering Discharge NPDES Stormwater Discharge Permit
STATE	
Executive Office of Environmental Affairs/MEPA Unit	MEPA Certificate of Compliance Environmental Notification Form *on ENF Issued July 8, 1993)(Certificate* Draft Environmental Impact Report *(DEIR Certificate Issued December 16, 1993)*

Agency Name	Anticipated Permit or Action
STATE (cont'd)	Final Environmental Impact Report
Department of Environmental Protection	
- Division of Air Quality Control	Pre-Demolition Notice Pre-Asbestos Removal Notice Pre-Construction Notice
- Division of Water Pollution Control	Dewatering Discharge
- Division Of Water Supply	Water Supply Permit
Massachusetts Water Resources Authority	Sewer Use Discharge Permit Sewer Connection/Extension Permit
Department of Labor and Industries	Asbestos Removal Permit
LOCAL	
Boston Redevelopment Authority/Boston Zoning Commission	Article 31 Development Review Project Notification Form *(Scoping Determination Issued by BRA 7/21/93)* Draft Project Impact Report *(Preliminary Adequacy Determination Issued by BRA 5/2/94)* Final Project Impact Report Development Impact Project Plan and Agreement *(Authorized by BRA 3/10/94)* Cooperation Agreement (*Authorized by BRA 3/10/94)* Boston Residents Construction Employment Plan *(Authorized by BRA 3/10/94)* First Source Agreement *(Authorized by BRA 3/10/94)* Institutional Master Plan *(Approved by BRA 3/10/94 and by Zoning Commission 3/29/94)* Institutional Zoning District *(Approved by Zoning Commission 3/29/94)*
Boston Transportation Department	Transportation Access Plan Traffic Maintenance Plan
Boston Water and Sewer Commission	Water and Sewer Tie-In Approval Discharge Permit for Dewatering Sewer Use Discharge Permit

Agency Name	Anticipated Permit or Action
LOCAL (cont'd)	
Boston Inspectional Services Department	Demolition Permit Earth Removal Permit Building Permit
Boston Licensing Board	Storage of Flammables and Chemicals License to Erect and Maintain a Parking Garage
Boston Air Pollution Control Commission	Construction Noise Regulations Compliance
Boston Department of Public Works/Public Improvements Commission	Easements for Street/Sidewalk Alteration/Encroachments Permit Street Occupancy Permit Curb-Cut Permit Overhead Bridge Connections Sub-Surface Tiebacks

6.0 COMMUNITY REVIEW

In addition to a thorough analysis and review by agencies of the City of Boston and Commonwealth of Massachusetts, the Project has undergone local community review which included review of the Dana-Farber Institutional Master Plan.

6.1 Interested Parties

Community groups, abutters and individuals which may have interest in the Project are listed below:

Name	Relationship to Project
Brigham and Women's Hospital	Abutter
Children's Hospital	Abutter
Medical Area Total Energy Plant	Abutter
Mission Hill Planning and Zoning Advisory Committee	Community Group
Mission Hill Neighborhood Housing Services	Community Organization

Name	Relationship to Project
Medical Academic and Scientific Community Organization (MASCO)	Professional Organization
Boston Building Trades	Professional Organization

6.2 List of Meetings

Met With	Purpose	Date
BRA	Informal Presentation of Proposed Project	3/28/93 5/24/93 5/21/93
	Presentation of Proposed Project and Discussion of Procedural Process	5/25/93 6/11/93 6/21/93 7/7/93
	Review of Project Plans and Refinement of Building Design	7/20/93 8/10/93 8/31/93 9/9/93 9/17/93
	Review of Institutional Zoning Amendment	3/8/94
	BRA Board Public Hearing and Approval of Revised Project Design, Plans & Institutional Master Plan	3/10/94
MEPA, BRA and community representatives	Mepa Consultation Session - Presentation of Above Project; Community Input Hearing	6/30/93
BCDC	Presentation of Project Plans	10/5/93
	BCDC Subcommittee Meeting	10/20/93 11/3/93 11/30/93 12/7/93
	BCDC Approval of Project	3/8/94
Mission Hill PZAC	Presentation of Project to the Mission Hill Community	11/9/93
	Presentation of Revised Project Plans	3/1/94

Met With	Purpose	Date
Boston Environment Department	Review DPIR/DEIR Presentation of Project Plans	11/24/93
Boston Transportation Department	Review Transportation Access Plan	3/2/94
Zoning Commission	Public Hearing & Approval of Institutional Master Plan and Dana-Farber Cancer Institute Institutional District	3/29/94

7.0 RELATIONSHIP OF PROJECT TO OVERALL LONGWOOD MEDICAL AREA PLANNING

The Dana-Farber Cancer Institute is an active participant in City-sponsored master planning for the Longwood Medical and Academic Area. This effort, being directed by the Boston Redevelopment Authority in coordination with LMA institutional representatives, MASCO and residential community participants from nearby Fenway and Mission Hill, is scheduled for completion in calendar year 1994. The proposed Smith Research Laboratories Project has been reviewed by the BRA as it relates to the current LMA planning effort. The Project is consistent with general principles guiding this study, including mitigation of negative impacts on the City's existing housing stock, existing park land or open space resources. It also consolidates existing inefficient uses into one facility and provides for joint use of space with another nearby institution which are objectives of the City's planning program.

The Smith Research Laboratories Project is being planned at the same time that the New England Deaconess Hospital is proposing a Research Facility (EOEA #8776) on the other side of Brookline Avenue, and Harvard Institutes of Medicine is proposing the conversion of the former English High School to a Research Facility (EOEA #9428). These projects and the Dana-Farber Project demonstrate the importance of new research to the survival and leadership of these institutions in their key research areas. Research supports not only medical education but clinical excellence, a critical aspect of all of these Harvard teaching facilities.

The Deaconess and Harvard projects have completed their environmental reviews. The construction planning of both of these projects will be coordinated with the Dana-Farber Project to minimize street occupancy and traffic disruption through the Transportation Access Plan and Traffic Maintenance Plan Agreements with the City, required for each project.

MASCO's LMA Transportation Study, updated in 1992, continues to be used as a framework for implementing access improvements within the LMA. (See Appendix D, Letter to Dana-Farber from MASCO, for listing of these improvements.

II. SUMMARY OF PROJECT, ENVIRONMENTAL EFFECTS AND MITIGATION

DANA-FARBER
CANCER INSTITUTE

II. SUMMARY OF THE PROJECT, ENVIRONMENTAL EFFECTS AND MITIGATION

1.0 PROJECT SUMMARY

1.1 Changes to Project Design Since the Filing of the DEIR/DPIR

In response to community input, and further review by the BRA and the BCDC, Dana-Farber has made a number of design changes to the proposed Smith Research Laboratories (the "Project") as follows:

- The size of the Project has been reduced by one floor, reducing the total building program by 24,728 square feet.

- Building height has been reduced from 194 feet to 184 feet.

- The proposed building has been shifted away from Binney Street, providing an additional 12 feet of sidewalk along Binney Street (total of 19 feet) and eliminating the need for the pedestrian colonnade along this side of the building. The colonnade along the western side of the building and the small park have been also replaced by a plaza for employees.

- Total parking has been reduced from 261 to 246 spaces.

- The parking garage access has been incorporated within the first floor plan instead of outside the building. In order to accommodate this change, the width of the building along Deaconess Road has increased slightly (6 feet).

- The overhead bridge from the Project to Brigham and Women's Hospital has been eliminated.

- The existing bridge between the Jimmy Fund Building and the Dana Building will be replaced with a new bridge connecting the Jimmy Fund Building to the Project that better meets current City/ BRA design standards.

- The resulting FAR for the revised project is 7.4 (vs. 8.27 for the DPIR/DEIR) and the total combined FAR of the Project site with the Redstone Building site is now only slightly in excess of 5.0 vs. the previous 5.7 FAR with the DPIR/DEIR project design.

1.2 Project Description

The Project will add 213,592 gross square feet (gsf) of space (for FAR purposes) in a 13-story building containing a 246-space, below-level garage. It will be located on a 28,845 square-foot site, currently occupied by a 3-story building used by Dana-Farber, a small garage, and a 58-car surface parking lot. The site is situated across from the Institute's principal Dana Building which houses outpatient clinics, research space, beds and administrative offices. The Project will include an overhead bridge over Deaconess Road at the third level, designed to be as high and light as possible, connecting to the Dana Building to facilitate the movement of researchers and physicians between these facilities. The existing second floor bridge connection between the Jimmy Fund Building and the Dana Building will be replaced with a higher bridge, at the third level, which will connect the Jimmy Fund Building to the Smith Research Laboratories.

As part of the Project, space will be provided for the research needs of Brigham and Women's Hospital (BWH) which is nearby on the opposite side of Binney Street. Dana-Farber and BWH conduct complementary research, the results of which advance the work of each institution. BWH's research needs have also expanded dramatically and the close proximity of the two institutions promotes continued interaction between them.

The Project's design and building program has continually evolved during the past twelve months following discussions with the BRA and its urban design staff, and with community residents. The revised design is for a building of approximately 184 feet above-grade plus rooftop mechanical space. Corner setbacks at the top two floors will reduce the perceived mass of the building. The below-level garage will be accessed from Deaconess Road to link the garage more directly to Brookline Avenue and away from Binney Street. Bicycle racks will be provided adjacent to the garage entrance on the west side of the building to encourage this form of transportation to the site. The Project's off-street loading docks will be located on Binney Street, and will include three bays enclosed within the first (street) level.

2.0 SUMMARY OF ENVIRONMENTAL EFFECTS

The potential environmental effects of the Project were evaluated in the DPIR/DEIR in accordance with City and State requirements. The results of these analyses are summarized below. In some instances, additional studies were performed for this FPIR/FEIR in response to the BRA's Preliminary Adequacy Determination on the DPIR and MEPA's Certificate on the DEIR.

2.1 Transportation

2.1.1 Traffic Operations

A comparison of delay times and reserve capacities under the No-Build and Build conditions shows that the Project traffic has little effect on overall operating conditions at the intersections analyzed. The most significant impact will occur at the intersection of Brookline Avenue and Deaconess Road where LOS F conditions will occur during the AM peak hour, due to the garage's proximity. In order to help improve traffic operations in the area, Dana-Farber will donate $45,000 to the City for general improvements at and around the intersection of Deaconess Road and Brookline Avenue. Additional mitigation provisions will be included in the Transportation Access Plan Agreement between Dana-Farber and the City of Boston, which is summarized in Section 4.0 of Chapter IV.

2.1.2 Parking

The construction of the Project will result in a net increase in total parking supply of 188 spaces* from the current inventory of 740 spaces. Based on parking demand calculations, all patient and visitor demand will be met by the 138 spaces at the Dana Building, leaving 790 spaces to meet a demand for 970 employee spaces. In order to meet the additional, although modest, demand generated by the Project, it will be necessary to adopt appropriate mitigation measures.

2.1.3 Public Transportation

The Project is expected to increase public transportation use, including MASCO's Metro Bus Service, by approximately 108 passenger trips during the AM peak hour and by 102 during the PM peak hour. This reflects a modest increase in ridership which should easily be absorbed by the MBTA and MASCO.

2.2 Wind

Currently, the open Project site and its vicinity are quite sheltered from winds from any direction because of the many surrounding buildings three to 20 stories high. There is no place at the site or in the immediate surrounding area that has excessive pedestrian level winds (PLWs) (i.e., PLWs in Melbourne's Categories 1 or 2) or that exceeds the BRA guideline return period effective gust wind speed of 31 mph once in 100 hours. In fact, there is probably no

* This reflects a deduction for the 58 spaces on the existing site, but not the 65 spaces recently lost to 5th floor renovations at the Dana Building.

place in or near the site where, on average over a year, the winds are greater than Melbourne Category 3.

The Project is similar in height to many of the surrounding buildings and thus is not expected to have serious adverse effects on PLWs at or near the site. The site will remain sheltered from easterly storm winds, and for southwest summer winds. For northwest winds, the Project may cause some added windiness along Deaconess Road, primarily under the proposed bridge connecting the Project to the existing Dana Building. However, since the main pedestrian entrance to the new building will be about 45 feet nearer Binney Street, winds there will be light. The most notable effect for northwest winds will likely be in the walkway next to the MATEP facility where winds may increase to high Category 3 near the west corner of the Project.

With the removal of the diagonal existing bridge between the Dana and Jimmy Fund Buildings, PLWs at the intersection of Binney Street and Deaconess Road will be improved. Winds under the replacement bridge across Binney Street between the Project and the Jimmy Fund Building will be in Category 3. Otherwise, the new building will probably reduce winds on Binney Street.

All entrances to the Project will have winds in Category 4 or 5, and winds at the main entrance to the Dana Building, which are currently in Category 5, will be unaffected by the Project.

2.3 Shadows

The Project is comparable in height to many surrounding buildings. This fact, and the presence of other tall buildings nearby, result in few new shadows. New shadows from the Project will be limited primarily to the block itself, and the adjacent Deaconess Road and Brookline Avenue. Although the small on-site plaza on the west side of the proposed building will be shaded much of the time, none of the off-site sensitive areas will be impacted by new shadows from the Project during times when these areas will be most heavily used (spring through fall). Based on the additional shadow diagrams prepared for this report, a portion of Joslin Park will be affected by new shadows during the winter late morning hours (for approximately two hours a day from November through January), although this is not a time when the park is expected to be heavily used. The Project will not impact the park during any other time periods. No other sensitive areas will be affected by new shadows from the Project.

2.4 Daylight

The amount of daylight obstructed with the proposed building will increase compared to existing conditions, as would be expected when building on a partially vacant lot. Of primary concern to the BRA was the amount of daylight obstruction along Binney Street. This amount has been reduced because of changes in the design resulting in an increased setback from Binney Street and a reduction in building height by 10 feet. In terms of daylight obstruction, the proposed design is comparable to other buildings in the area. For Deaconess Road, daylight obstruction is greater for the viewpoint centered directly on the building but is considerably less for the average case when the viewpoint is centered on the city block.

Overall, the amount of daylight obstructed by the proposed building will increase from existing levels but is comparable to the levels of daylight obstruction in the LMA.

2.5 Air Quality

The result of the microscale analysis demonstrates that ambient air quality standards for CO will be maintained with construction of the Project. Further, any concentration increases that occur are small since the Project is a relatively small traffic generator.

Only trace quantities of constituents will be emitted from the laboratory vents. In addition, data collected from existing near field monitors in the project area demonstrate that air quality associated with the MATEP facility is acceptable; thus adverse effects from the MATEP stack are not expected at the Smith Research Laboratories.

2.6 Water Quality

The Project is not expected to have adverse effects on water quality. The Smith Research Laboratories will be constructed on a site which is currently impervious, containing a building and a paved parking lot. With construction of the Project, the quality of storm water being discharged into the storm water system should improve, as a result of the installation of controls in the parking garage. Clean rain water will be drained from the roof of the building into the storm water system. Runoff in the proposed below-grade parking garage will run through a sand interceptor and then oil/water separators before being pumped into the gravity storm water system.

Dewatering will be required during construction of the underground parking garage. A permanent dewatering system will also be required as the lowest parking level will be below groundwater.

Sanitary sewage is estimated at 49,950 gallons per day (gpd) based on a 10% reduction of the water consumption estimate for the Project. It is estimated that cooling tower blowdown during peak summer months will generate an additional 60,000 gpd. The Project will also meet all applicable code requirements for the installation of low-flow fixtures, which will minimize sewage generation.

No chemical or biological waste will be discharged into the sewer system. Chemical and biological waste from laboratories will be collected into appropriate containers and properly disposed. Liquid waste entering the sanitary sewer system will meet all standards for effluent discharges. The laboratory drainage system will be equipped with an automatic chemical treatment system to control pH levels of laboratory waste entering the sewer system.

The design and construction of all service connections will be performed to the standards of the Boston Water and Sewer Commission (BWSC). Existing sewer connections to the surrounding area will be maintained during construction of the Project. If interruptions are necessary, they will be coordinated with the BWSC. All connection plans will be subject to BWSC review and approval.

2.7 Solid and Hazardous Waste

Some solid waste will be generated during demolition of the on-site building and construction of the Project although materials will be recycled to the maximum extent practicable. During operations, additional solid waste will be generated by the Project, due to the increased research uses and additional support space. Three types of hazardous waste are generated by the Dana-Farber Cancer Institute: infectious, chemical and low-level radioactive waste. The types of waste generated by the Project will be the same as what is currently generated at the Institute. All solid waste is currently collected by a licensed contractor. Laboratory waste will also be removed by a licensed contractor, as is currently done.

2.8 Noise

The City of Boston Noise Ordinance specifies performance criteria based on the land use of the receiving property. Noise emitted from each source was modeled at 12 sensitive receptors around the site. Results of the analysis

indicate that the requirements of the Boston Noise Ordinance can be met using common noise control measures.

2.9 Geotechnical

The ground surface at the site is approximately El.43 feet, and the bottom of the structure (Level P6) will be at approximately El-21, with a partial lower level for mechanical equipment at approximately El.-31. The lowest level (El.-31) is about 40 to 50 feet below groundwater level. Dewatering will be required during construction activities. The slab of the building will be designed to resist water uplift pressures. Dewatering will be required until enough of the building is constructed that its weight would exceed the uplift pressure from the water. A permanent dewatering system and waterproofing of the foundation walls will also be installed to prevent seepage of groundwater into the structure in the long-term.

To isolate the building from vibrations, the building must be founded on bedrock and be isolated from the surrounding soil. To accomplish this, the basement walls will be constructed as slurry walls extending to bedrock, with lateral support provided by permanent tiebacks anchored into the glacial till and bedrock. The basement floors and building superstructure will be supported on a combination of spread footings and short caissons founded on bedrock. The basement floors will be isolated from the basement walls by isolation joints located just inside the walls.

2.10 Construction

Temporary construction impacts will include increased truck traffic near the site, elevated noise levels and fugitive dust.

The construction of the Project is expected to start with site preparation and demolition of on-site buildings beginning in July, 1994. Construction will extend for approximately 36 months. Normal construction hours for the project will be from 7:00 AM to 4:00 PM, Monday through Friday. Certain construction activities such as steel erection, foundation preparation, and concrete casting may require extended hours or work on Saturdays.

The garage will be located below-grade, under the Smith Research Laboratories. During garage construction, excavation of the below-grade area will be performed, utility relocations will occur and dewatering will be required.

On-site staging areas will be located along the edge of the construction site. Because of the limitations of the site, it is anticipated that truck unloading and foundation installation will require use of portions of the sidewalks and streets along Binney Street and Deaconess Road adjacent to the site. Negotiations are currently underway with the Boston Transportation Department as part of the development of the Traffic Maintenance Plan which outlines traffic movement during construction and other construction related activities.

It is anticipated that the sidewalk adjacent to the site on the south side of Deaconess Road will be closed to pedestrian traffic from the Redstone Building service drive to the corner of Binney Street. Pedestrians will be diverted to the north side of Deaconess Road at the corner of Brookline Avenue or near the entrance to the parking lot west of the site. It is also anticipated that the sidewalk adjacent to the site on the west side of Binney Street will be closed to pedestrian traffic from the MATEP facility to the corner of Deaconess Road. Pedestrians will be diverted to the east side of Binney Street at the corner of Francis Street or at the MATEP service entrance.

Although not a public way, the lightly-traveled walkway between the site and MATEP will be closed to pedestrians except that egress from the Redstone Building will be maintained.

To make removal of excavated material and deliveries to the site in an orderly manner, it is proposed to use a portion of Deaconess Road for a truck loading area adjacent to the site. This area would be fenced off from the west corner of the site to the corner of Binney Street to separate it from pedestrian and vehicular traffic.

During the construction period of the Project, temporary minor effects on air quality at, and adjacent to, the site may occur. Effects associated with demolition, land clearing, ground excavation, and other construction activities may generate fugitive dust, which will result in localized increases in airborne particulate levels. Fugitive dust emissions from these activities will depend on such factors as the properties of the emitting surfaces (e.g., soil silt content, moisture content, and volume of spoils), meteorological variables, and construction practices employed.

The noise levels from the operation of construction equipment are highly variable. The City of Boston Noise Regulation limits the maximum noise levels from regulated construction equipment to 86 dBA. Based on maximum noise levels of individual pieces of operating equipment and the number of pieces expected on the Site, the maximum levels at the point where the regulations

apply are expected to range from 75 dBA to 85 dBA. The results indicate that the Project will comply with maximum noise level limits established by the City of Boston.

2.11 Historic Resources

There are no historic resources adjacent to the Project site. The nearest historic structures are the former Massachusetts College of Art building at the corner of Brookline Avenue and Longwood Avenue, which is currently part of Beth Israel Hospital and undergoing expansion, and the Rotch Memorial Hospital at 55 Shattuck Street. These buildings are about two blocks away from the Project site.

All of the buildings immediately surrounding the site are relatively modern structures, constructed in varied architectural styles. None of the historic resources are near enough to the Project so as to be potentially affected by it. The Project will not physically alter a historic resource nor will it alter the surroundings of a resource. Likewise, access or views of the historic properties previously identified will not be impacted in any way by the Project.

In addition, shadow studies performed for the Project show that the new building will not create new shadows on any of the historic properties identified.

2.12 Infrastructure

2.12.1 Water Supply

Water demand for the Smith Research Laboratories is estimated to average approximately 55,500 gallons per day (gpd). This estimate is based on water consumption records at other Dana-Farber facilities and water use rates in similar laboratory research facilities. The peak flow rate for the research facility is estimated to be 117 gallons per minute (gpm) based on a peaking factor of 3.

The Project will also include a refrigeration plant. The refrigeration plant will be operated by MATEP and will serve the needs of the Smith Research Laboratories, other Dana-Farber buildings and LMA needs. The plant capacity will be approximately 4,000 tons. Currently, plans are to operate the chiller plant as a peaking facility, operating only during the warmer two months of the year (July and August). The plant's water consumption is conservatively based on a 4,000-ton capacity and estimated to be:

- 67,700 gpd average, assuming operation on year-round basis.
- 158,200 gpd average during the peak months of July and August.

Based on recent hydrant test data for the project vicinity, sufficient system capacity is available. No system problems in the area have been identified by the Boston Water & Sewer Commission.

2.12.2 Wastewater

Sanitary sewage generated by the Project is estimated to be approximately 49,950 gpd, based on a 10% reduction of the water consumption estimates calculated for the Project.

It is estimated that cooling tower blowdown will average an additional 25,000 gpd on an annual basis. The average blowdown during a peak month will be approximately 60,000 gpd.

The Project will not impact storm water runoff as the site is currently impervious and will continue to be with construction of the Project. Additional controls will be emplaced to remove contaminants from runoff in the garage.

2.12.3 Energy Systems

Heating for the Smith Research Laboratories will be provided by the MATEP facility. Based on typical energy requirements for similar facilities, heating for the Project will total approximately 48,750 million Btu/year.

Cooling requirements for the Smith Research Laboratories will be met by the 4,000-ton refrigeration plant to be constructed as part of the Project.

Electrical requirements for the Project are estimated to be approximately 26,100,000 kilowatt hours per year. Electric power for the building will be provided from MATEP's 13.8 kV distribution grid. An approximately 7,000 kva service will be extended from a utility manhole located on Binney Street adjacent to the property. The transformers and service equipment will be located within the building in a dedicated room with direct access to the street. The total emergency power requirement for the building is estimated at approximately 1,475 kW.

Gas for the Project will be provided by Boston Gas Company via a 4-inch gas line under Binney Street. Natural gas in the building will be used only for laboratory burners. Sufficient gas capacity is available from the current system to meet the Project's needs.

3.0 SUMMARY OF MITIGATION

The current design of the Project has resulted from extensive negotiation with the BRA, BCDC, BTD, Mission Hill PZAC and other interested parties. Potential effects of the Project have been mitigated, as summarized below.

3.1 Transportation

The Institute and BTD are in the process of negotiating a Traffic Maintenance Plan which will address pertinent construction traffic issues. This is discussed more fully in Section 3.10 under construction mitigation.

3.1.1 Roadway Improvements

Dana-Farber will contribute $45,000 to the City to assist in signal improvements at and around the intersection of Brookline Avenue and Deaconess Road and at other intersections along Brookline Avenue between the Riverway and Longwood Avenue. The Institute will also cooperate with MASCO in its ongoing efforts which incudes improving signal timing and traffic operations within the LMA, as discussed in MASCO's letter to Dana-Farber contained in Appendix D.

3.1.2 Demand Management

To achieve parking demand reductions on the Dana-Farber campus, a number of demand management measures are currently being implemented as follows:

Educate Employees

The Institute educates each employee so that all prospective and current employees understand each of the commuter options and its benefits and costs. This process helps inform employees about driving alone versus other commuting modes.

- The Commuter Services Department has expanded operations to provide literature to drivers on mass transit fares, schedules, and routes; ride source and CommuteWorks information; T-pass employee subsidy incentives; off-campus parking lot locations and incentive fees; and lists of carpools and vanpools looking for riders.
- Dana-Faber takes an active role in MASCO's CommuteWorks program.

Promote Mass Transit

Dana-Farber currently allows employees to purchase MBTA monthly T-passes on a cash or payroll-deduction basis. The Institute provides a 25% subsidy of T-passes. This is typical of other subsidies in the LMA. The Institute currently provides a convenient on-campus location for purchasing MBTA passes and actively encourages their use by in-house mailings.

Through its membership in MASCO, Dana-Farber is aware of the Greater Boston Medical Commuter Services Council. This Council is negotiating with the MBTA for development of full service transportation centers (FSTCs) within the LMA. Through the FSTC, patients, visitors and employees would be able to purchase all MBTA tokens and commuter passes on-site.

Promote Ride Sharing

The CommuteWorks agency utilizes the Ride Source computer program that enables employees to contact other LMA employees interested in sharing a ride to and from work. CommuteWorks provides registration cards, monthly computer matching services, and follow-up services to ensure easy transition from driving alone to carpool/vanpool mode. Dana-Farber works closely with CommuteWorks to increase ride sharing by employees. By utilizing 8-passenger vans, overall vehicle occupancy rate is being increased.

Many employees are apprehensive about ride sharing because of a fear of not being able to get home in the event of an emergency. Therefore, in conjunction with carpool/vanpool services, an Emergency-Ride-Home program is being reviewed so that employees belonging to a carpool/vanpool who are confronted with an emergency during the day can get a ride home. This program requires supervisor approval before an employee can obtain the emergency ride. The vehicle used can be either a Dana-Farber van (schedule permitting) or a local taxi company.

Alternative Work Hours

The Institute allows employees, on an informal basis, to participate in flexible work hours to the maximum degree permitted by the nature of their work and the requirements for control. This allows employees to select from transit schedule times without being pressured to arrive at a specific time. Flexible work hours encourage employees to form carpools according to their schedules. By adjusting the arrival and departure times of employees, the area-wide vehicle congestion can be substantially reduced during the peak traffic hours.

Encourage Walking/Cycling

Improved lighting and security in the LMA will encourage people to walk or bicycle to work. A program to educate people on safe and convenient walking routes has been implemented at the Institute, along with increased protection wherever and whenever feasible. In addition, the Institute provides bike racks/cages at the Dana Garage and will continue to do so at the new facility. The goal is to have 8% of the work force walking and/or bicycling to work in 1998.

3.2 Wind

All entrances to the Project will have winds in Category 4 or 5, and winds at the main entrance to the existing Dana Building, which currently are in Category 5 will be unaffected.

The revised Project design, which includes replacement of the diagonal bridge at the intersection of Binney Street and Deaconess Road, will improve conditions at the Binney/Deaconess corner. In general, the Project will probably reduce some of the current windiness along Binney Street.

3.3 Shadows

New shadows from the Project will be limited primarily to the block itself, and the adjacent Deaconess Road and Brookline Avenue. The Project is comparable in height to many surrounding buildings. This fact, and the presence of other tall buildings nearby, result in few new shadows. None of the off-site sensitive open areas are impacted by new shadows from the project during times when these areas will be most heavily used.

The building has been notched at its corners and stepped back at the top two floors, reducing the amount of shadows generated by the Project. In addition, the current design is one floor lower than the DPIR/DEIR project, representing a reduction from 14 to 13 floors, which will slightly lessen new shadows from the Project.

3.4 Daylight

The amount of daylight obstructed by the proposed building will increase from existing levels but is comparable to the levels of daylight obstruction in the Longwood Medical Area. The Project has been designed to minimize the amount of daylight obstruction as much as possible, with the stepped back top levels and the corner reductions.

The revised design incorporates an additional 12 foot building setback along Binney Street to address daylight concerns along this street. The resulting daylight obstruction along Binney Street is less than with the DPIR/DEIR design. In addition, the two proposed overhead bridges have been redesigned to appear lighter and more transparent. The Jimmy Fund replacement bridge at the third level over Binney Street between the Project and the Jimmy Fund Building will further reduce daylight obstruction as compared to the existing second level bridge to be demolished.

3.5 Air Quality

The results of the microscale analysis demonstrate ambient air quality standards for CO will be maintained with construction of the Project. Garage exhaust vents will be located away from pedestrians at the fourth level.

The Project was designed taking into account the downwash concerns of the MATEP stack, thus the building is not expected to have any adverse effects on downwash. Laboratory venting of exhaust and fume hoods will be designed to provide sufficient dilution to ensure that all exhaust gases are away from pedestrians.

3.6 Water Quality

The Project will have separate storm water and sanitary sewer connections. With construction of the Project, the quality of storm water being discharged into the storm water system should improve, as a result of the installation of controls in the parking garage. Clean rain water will be drained from the roof of the building into the storm water system. Runoff in the proposed below-grade parking garage will run through a sand interceptor and then oil/water separators before being pumped into the gravity storm water system.

Dewatering discharge will be tested to ensure that it meets all applicable standards prior to being discharged into the City storm water system. Permits for dewatering will be obtained from the Environmental Protection Agency (EPA) and the BWSC prior to commencing dewatering operations.

3.7 Solid and Hazardous Waste

All solid waste is currently collected by a licensed contractor. The building design will include storage space for recyclable materials. Due to the nature of the research conducted at the Institute, many materials are not recyclable. However, Dana-Farber currently conducts a recycling program for paper products in an effort to reduce the amount of solid waste generated by the Institute. This program will also be maintained in the Project. During

construction, demolition and construction materials will also be recycled to the maximum extent practicable.

All hazardous waste is handled and disposed of in accordance with all applicable laws and regulations relating to the collection, transportation and incineration of hazardous waste.

All hazardous chemicals leaving Dana-Farber's premises are packaged and transported in accordance with U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT) and Massachusetts Department of Environmental Protection (DEP) rules and regulations and a detailed health and safety plan. All low level radioactive waste is handled in accordance with NRC rules and regulations.

Dana-Farber has developed emergency response procedures for handling chemical spills. Emergency Response Team personnel have been trained in the safe handling of chemical spills at the Institute.

3.8 Noise

Dana-Farber has made a significant commitment to noise control in the Project design. The specific noise controls used will be selected in the final design to meet the Boston standards. Mitigation measures to be incorporated in the building design to control noise from project sources may include but are not limited to the following:

- Installation of noise control louvers on some or all building openings.
- Installation of stack silencers on the hood fan exhaust stacks.
- Installation of silencing material in the ductwork and plenums associated with the building ventilation system.
- Optimizing the arrangement of the various pieces of equipment on the mechanical floors to reduce the resulting outside sound levels.
- Application of sound absorptive material around the cooling tower area.
- Installation of fans designed to operate with lower noise levels.
- Installation of add-on attenuator equipment to specific pieces of equipment.

3.9 Geotechnical

The basement walls will be constructed as slurry walls extending to bedrock, with lateral support provided by permanent tiebacks anchored into the glacial till and bedrock. The slurry walls and tiebacks for the permanent basement walls will also serve as the excavation support system during construction. The slurry walls will be designed to control ground movement outside the excavation and protect the adjacent buildings and utility tunnel. The slurry walls will also provide a groundwater cut-off to bedrock. The tiebacks will be installed at an inclination to avoid adjacent building foundations and utilities.

The slurry walls will be much stiffer than conventional excavation support systems and will be toed into bedrock to prevent movement of the bottom of the wall. The vertical spacing of the tieback anchors will be designed to coincide with the basement floor levels, resulting in a relatively close spacing which will help to minimize wall movement during excavation. A geotechnical instrumentation program will be established to monitor movement of the slurry walls and adjacent structures during construction.

The slurry walls will extend to bedrock to provide a groundwater cut-off through the relatively pervious sand and glacial till strata located above the bedrock. The bottom level floor slabs will be designed as pressure-relieved slabs with an under-slab drainage system. The groundwater cut-off provided by the slurry walls will be used to minimize flow into the under-slab drainage system and to minimize groundwater drawdown outside the building. The slurry walls will also provide a groundwater cut-off for construction dewatering.

It is expected that groundwater drawdown in the soil outside the slurry walls will be minimal because the sand and glacial till strata above the bedrock are more permeable than the rock. As a precaution, grout sleeves will be installed inside the slurry walls so that any localized pervious zones in the rock below the slurry wall can be sealed by grouting. If some groundwater drawdown does occur outside the slurry walls due to unforeseen conditions, the impact on adjacent structures should be minimal because the clay stratum is heavily preconsolidated in this area.

Permits for dewatering will be obtained from the EPA (NPDES), DEP and BWSC prior to commencing construction activities.

3.10 Construction

A Traffic Maintenance Plan (TMP) is currently being prepared and will be submitted to BTD for approval prior to the start of construction. This plan

will include specific mitigation measures and staging plans to minimize effects on the abutters. A Construction Manager has already been selected by the Institute.

3.10.1 Construction Traffic

The Traffic Maintenance Plan will include the following measures:

- Secure staging, fencing and bracing will be provided to protect nearby pedestrian traffic.

- Appropriate pedestrian walkways will be covered at nearby construction locations.

- The removal of construction material and equipment will be staggered over the course of the weekday.

- Designated truck routes for the removal of construction equipment will be clearly defined. Limiting the effect of construction traffic and noise on the adjacent neighborhoods will be a goal of the truck routing plan. Routes will be chosen that use major thoroughfares as much as possible. Trucks will not use the residential section of Francis Street.

- Construction workers will be encouraged to use public transportation. Secured storage for tools will be provided on-site so that workers will not have to transport their tools to and from the site on a daily basis, thereby alleviating one need to drive to the site.

- In order to discourage driving to the site, no on-site parking will be available for personal vehicles. Past experience shows that the lack of free or subsidized parking discourages use of personal vehicles and increases carpooling. Construction workers who do drive will use off-street commercial parking spaces, or pending further discussion with MASCO, will be provided with space at MASCO's remote parking lots and shuttled to and from the job site.

- The arrival and departure times of construction workers will generally be during the off peak hours of commuter traffic.

3.10.2 Construction Air Quality

To reduce emissions of fugitive dust and minimize effects on the local environment, a number of strictly enforced mitigation measures will be adhered to. These include:

- During dry periods, using wetting agents on areas of exposed soil and demolition activities on a scheduled basis.
- Using covered trucks for transportation of excavated material and demolition debris.
- Minimizing storage of debris on-site.
- Locating aggregate storage piles away from areas having the greatest pedestrian activity.
- Monitoring of actual construction practices to ensure that unnecessary transfers and mechanical disturbances of loose materials are minimized.
- Periodic cleaning of streets and sidewalks to minimize dust accumulations.

3.10.3 Construction Noise

Although the results of weekday daytime ambient noise measurements show that existing L_{10} levels in some areas around the site are as high as 77 dBA, a project construction noise target of 75 dBA (L_{10}) at the nearest property line or 50 feet from the equipment was maintained for this study. The L_{10} level was estimated for each phase of construction, based on the type, number and usage of individual pieces of equipment. The L_{eq} levels ranged from 70 dBA to 73 dBA and the L_{10} levels are expected to be 72 dBA to 75 dBA.

3.10.4 Demolition and Disposal

The bulk of construction debris will consist of non-contaminated concrete, steel, metal, wood, brick, and roofing material. Some of the slate steel, wood, and metal may be salvaged and the rest will be removed by the contractor. The waste will be disposed of in an approved landfill under the authority of the contractor. The naming of specific sites for disposal is premature at this time since conditions and available disposal sites may change by the time construction begins. The demolition contractor will, however, assume full responsibility for disposing the debris efficiently and appropriately in accordance with applicable regulations.

Prior to demolition, the presence of asbestos within the Frederika Building will be determined. If asbestos is determined to be present, it will be removed a licensed contractor according to all applicable regulations governing asbestos handling and disposal.

3.10.5 Rodent Control

In order to control this infestation, the City has established requirements under the Massachusetts State Sanitary Code, Chapter II, 105 CMR 410.550 and the State Building Code, Section 108.6. Policy Number 87-4 establishes that extermination of rodents shall be required for issuance of permits for demolition, excavation, foundation, and basement rehabilitation. There are no known problems presently at the Site.

A rodent extermination certificate will be filed with the building permit application to the City. Rodent inspection monitoring and treatment will be carried out before, during, and at the completion of all foundation work for the Project, in compliance with the City's requirements. Rodent extermination prior to work start-up will consist of treatment of areas throughout the site, including alleyways, surrounding building exteriors, and building interiors. Any off-site rodent control measures, if necessary, will only be implemented with the prior approval of the appropriate landowners. During the construction process, regular service visits will be made in order to maintain effective rodent control levels.

3.11 Historic Resources

The Project has been designed to be compatible with the buildings in the area in terms of height, scale, and materials. No historic resources will be affected by the Project and therefore no new mitigation is proposed.

3.12 Infrastructure

3.12.1 Water Supply

The City's public water supply system will be protected by reduced pressure principle backflow preventers (RPZ) to be installed on the water services to the Smith Research Laboratories. A dedicated laboratory water system will be provided in the research facility. Potable water will be protected from the laboratory water system by an RPZ. All backflow preventers will be installed and permitted according to Massachusetts DEP Cross Connection Plan Approval (Permit BRP WS 09) requirements.

The Project will meet all applicable code requirements. The Project's design will incorporate provisions for water conservation, such as:

- 1.6 gallons per flush toilets;
- 1.0 gallons per flush urinals;
- 0.5 gpm electronic faucets; and
- Flow restrictors for other plumbing fixtures.

In addition, an induced draft cooling tower will be used for the refrigeration plant, instead of a "once through system" where all water use is consumptive for cooling. As a result, consumptive water use will be limited to makeup for evaporative, drift and blowdown losses. To further minimize water use, cooling tower use will be restricted to periods where the outside ambient temperature exceeds approximately 55°F. In addition, when the temperature is low enough, draft fans in the cooling tower will not be used in order to further reduce evaporative and drift losses and consumptive water use. In effect, at moderate temperatures, the cooling tower will act as a heat sink without the evaporative losses and makeup requirements normally associated with typical cooling tower operation.

3.12.2 Sanitary Wastewater

No chemical or biological waste will be discharged into the sewer system. These wastes will be collected into appropriate containers and properly disposed of. Liquid entering into the sanitary drainage system will meet all standards for effluent discharges. Laboratory drainage systems will be equipped with an automatic chemical treatment system to control the pH level of laboratory waste. Treatment system specifications will be fully detailed in a subsequent filing for Massachusetts DEP Major Sewer Connection Approval (Permit BWP IW 10).

The Project will also meet all applicable code requirements for the installation of low flow fixtures, to minimize sewage generation. Use of low flow fixtures can reduce water consumption and resultant sewage generation by up to 20%.

It is anticipated that the plant will be operated to meet only peak requirements during July and August. If so, the cooling tower system use will be restricted during the spring, fall and winter months, and blowdown discharge to the sewer would not occur.

The design and construction of all proposed service connections and system modifications will be performed to the standards of the BWSC and will be subject to their review and approval.

3.12.3 Storm Water Drainage

The existing on-site parking lot's storm water runoff currently drains into the area storm drainage system which eventually flows to the Muddy River. With construction of the Project, the quality of storm water runoff should improve due to the installation of controls in the garage parking areas. Clean rain water will be drained from the roof of the building. Storm water from the underground parking garage will be routed through a sand interceptor and then through an oil separator prior to being pumped into the BWSC gravity storm drainage system.

3.12.4 Energy Systems and Conservation

Emergency power will be provided to all safety systems and other selected systems and receptacles. A diesel oil fired system will be used for this purpose. An 8-hour fuel oil storage capability will be provided in the building. The fuel oil distribution system will include double wall piping and a fuel oil tank located in a properly fire rated enclosure with containment.

The Boston Gas Master Plan for development calls for system main upgrades in the LMA. These upgrades are currently underway. However, sufficient capacity is available from the current system to meet the Project's needs.

Energy conservation measures will be an integral part of the building design. Measures to be incorporated into the building design are described below:

- The building's indoor design temperatures for general office comfort will be:
    - Summer - 78 degrees Fahrenheit DB, 50% maximum relative humidity
    - Winter - 72 degrees Fahrenheit DB, 30% maximum humidity
- Indoor design temperatures for the laboratories will be:
    - Summer - 76 degrees Fahrenheit DB, 50% relative humidity
    - Winter - 72 degrees Fahrenheit DB, 50% controlled humidity
- Air Economizer Cycle - The air conditioning system will be equipped with energy saving dry bulb economizer control. This will enable use of 100% outdoor air for cooling when the outdoor conditions are favorable.

- Glycol System - A glycol system will be installed to reclaim waste energy from building exhaust systems that are not laboratory hood exhaust.

- High efficiency motors will be provided for motors operating 150 hours or more.

- Electronic energy saving ballasts with energy efficient lamps will be used for the general lighting system. The ballasts will not contain PCBs.

III. PROJECT DESCRIPTION

DANA-FARBER
CANCER INSTITUTE

III. PROJECT DESCRIPTION

1.0 DESCRIPTION OF THE SITE

The Project site consists of a little less than three-quarters of an acre of land (28,845 square feet), located at 65 Deaconess Road in Boston, Massachusetts. The site is within the Longwood Medical and Academic Area (LMA) and is bounded by Deaconess Road on the northeast, Binney Street on the southeast and MATEP on the southwest. On the northwest, it is bounded by Dana-Farber's Redstone Building at 462-464 Brookline Avenue and Children's Hospital's 454 Brookline Avenue parking lot building (see Figure III.1-1). Access to the site is from Deaconess Road.

The site is owned by Dana-Farber and currently includes a small 3-story building, used by Dana-Farber for administrative and some research space, a small one-story garage and a 58-car parking lot. The buildings will be demolished for construction of the Smith Research Laboratories. A small portion of the Redstone Building will also be torn down to accommodate the Project and the need for a pedestrian plaza along the western side of the building.

2.0 SURROUNDING LAND USES

The Project site is surrounded by other medical or institutional uses, including other Dana-Farber facilities. Dana-Farber's primary building, the Dana Building, is directly across Deaconess Road. Next to the Dana Building and fronting on Brookline Avenue is the Mayer Building, also owned and occupied by Dana-Farber. Across Binney Street is Dana-Farber's Jimmy Fund Building. Adjacent to the Jimmy Fund Building to the south is Brigham and Women's Hospital. The Medical Area Total Energy Plant (MATEP) facility, a large power generating plant servicing many of the LMA's institutions, is to the southwest. A passage way, connecting Brookline Avenue to Binney Street, separates the site from MATEP. The Brookline Avenue buildings which are to the northwest of the site include the Redstone Building, used by Dana-Farber for an animal laboratory, and a two-story medical building (454 Brookline Avenue) owned by Children's Hospital. Surrounding uses are primarily medical in nature, including Children's Hospital to the east and New England Deaconess Hospital to the west. The nearest residential area is on Francis Street across from Brigham and Women's Hospital, one block south of the site.

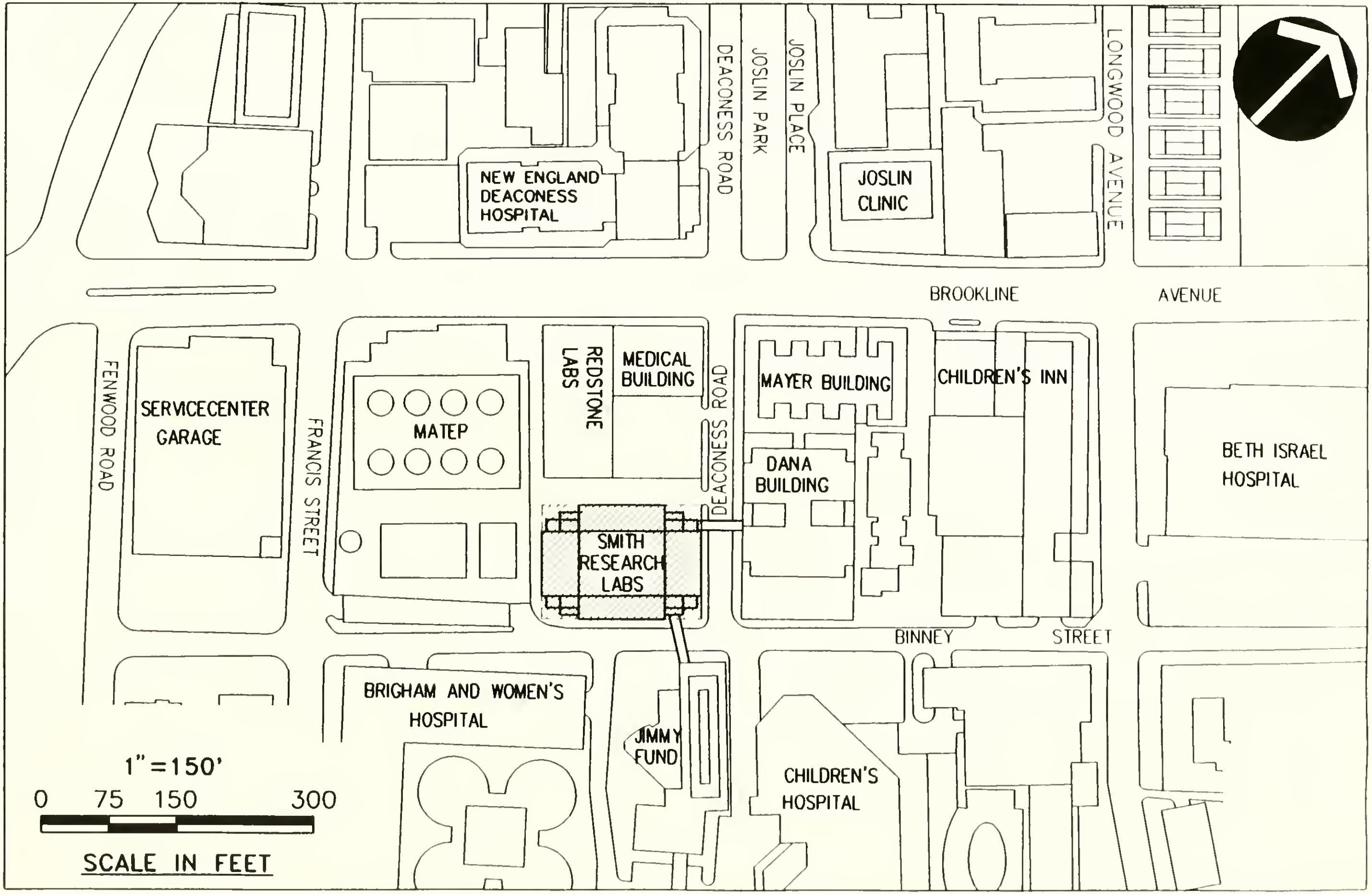

FIGURE III.1-1
PROJECT SITE LOCATION
SMITH RESEARCH LABORATORIES

The LMA is a very active area due to the presence of numerous hospitals and other health-related facilities. In addition, there are a number of commercial uses along Brookline Avenue, which primarily service the institutions (i.e. banks, drug stores, and eating establishments, etc.).

The Riverway, located about three blocks west of the site and along the banks of the Muddy River, is the largest public open space in the vicinity of the site. Other nearby open spaces include the City-owned Joslin Park, which is located one block northwest of the site across Brookline Avenue, and the Servicenter Garage sitting area and park at the corner of Francis and Binney Streets. The Windsor School recreational area, within two blocks of the site at Longwood and Brookline Avenues, includes several tennis courts and ball fields.

The aerial photograph included as Figure III.2-1 shows the urban context of the Project area. Figure III.2-2 also shows the open spaces described above.

3.0 PROPOSED PROJECT

3.1 Project Purpose

The Dana-Farber Cancer Institute is committed to the elimination of cancer as a serious health problem, through its programs in research, prevention, patient care, education and training. The Institute carries out research, study, teaching, clinical investigation, care of patients, and training of medical students, scientists, nurses, research assistants, and paramedical personnel.

The Institute has been designated by the National Cancer Institute as a Comprehensive Cancer Center, one of 27 in the country and only one in New England. The Institute is a leader in the development and clinical application of cancer treatment methodologies. It is the Institute's belief that clinical oncology and tumor biology are increasingly becoming a coherent body of knowledge, and that a major avenue for progress is to integrate clinical oncology, tumor biology, and cancer cause and prevention. Innovative efforts in the diagnosis and treatment of cancer require highly skilled and innovative clinicians and scientists.

To maintain and enhance progress in the causes, treatment and prevention of cancer and other diseases, the Institute must expand its research facilities which are already overcrowded. The proposed Smith Research Laboratories will provide the needed facilities to strengthen Dana-Farber as an institution at the forefront of cancer research.

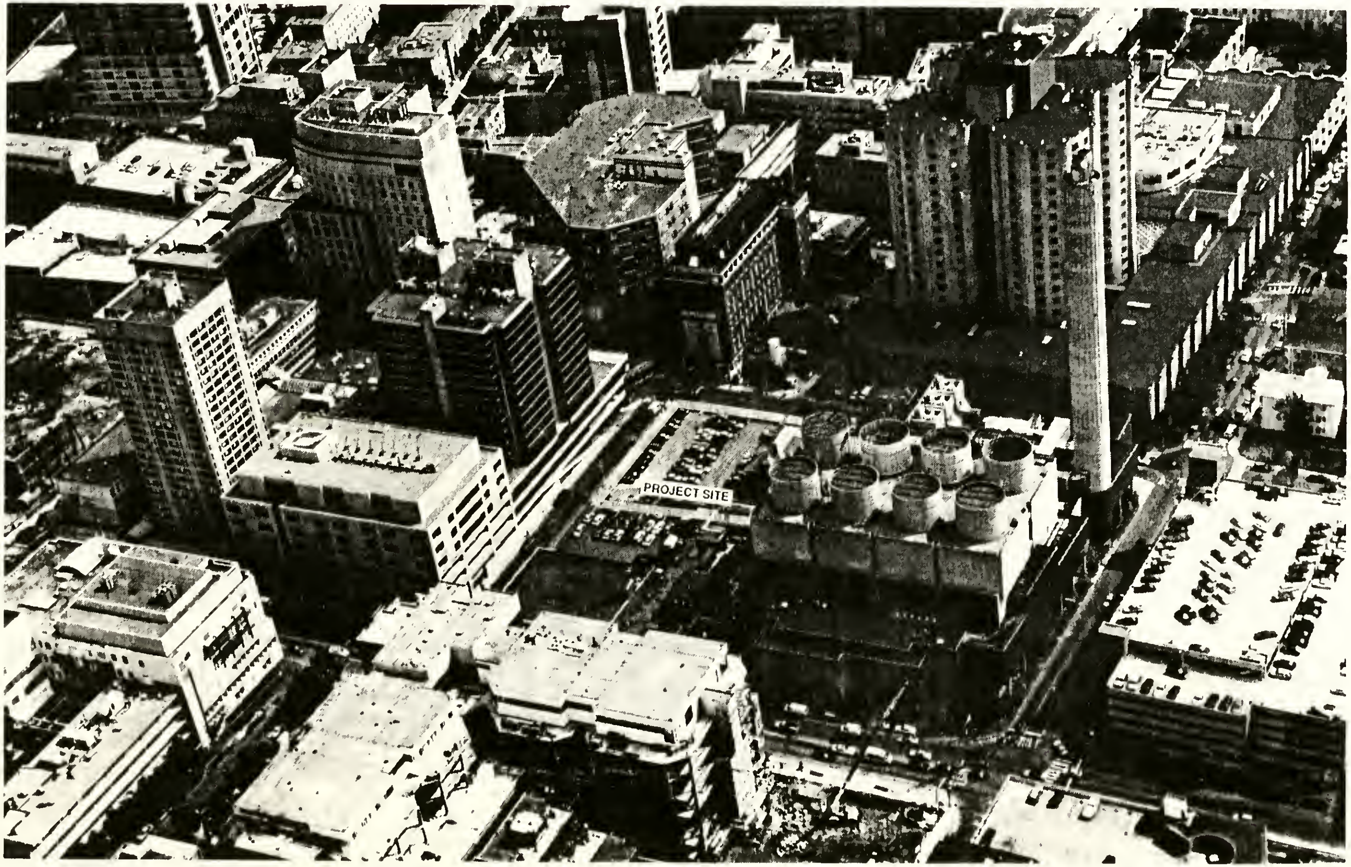

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FIGURE III.2-1
AERIAL PHOTO OF SITE LOOKING NORTHEAST
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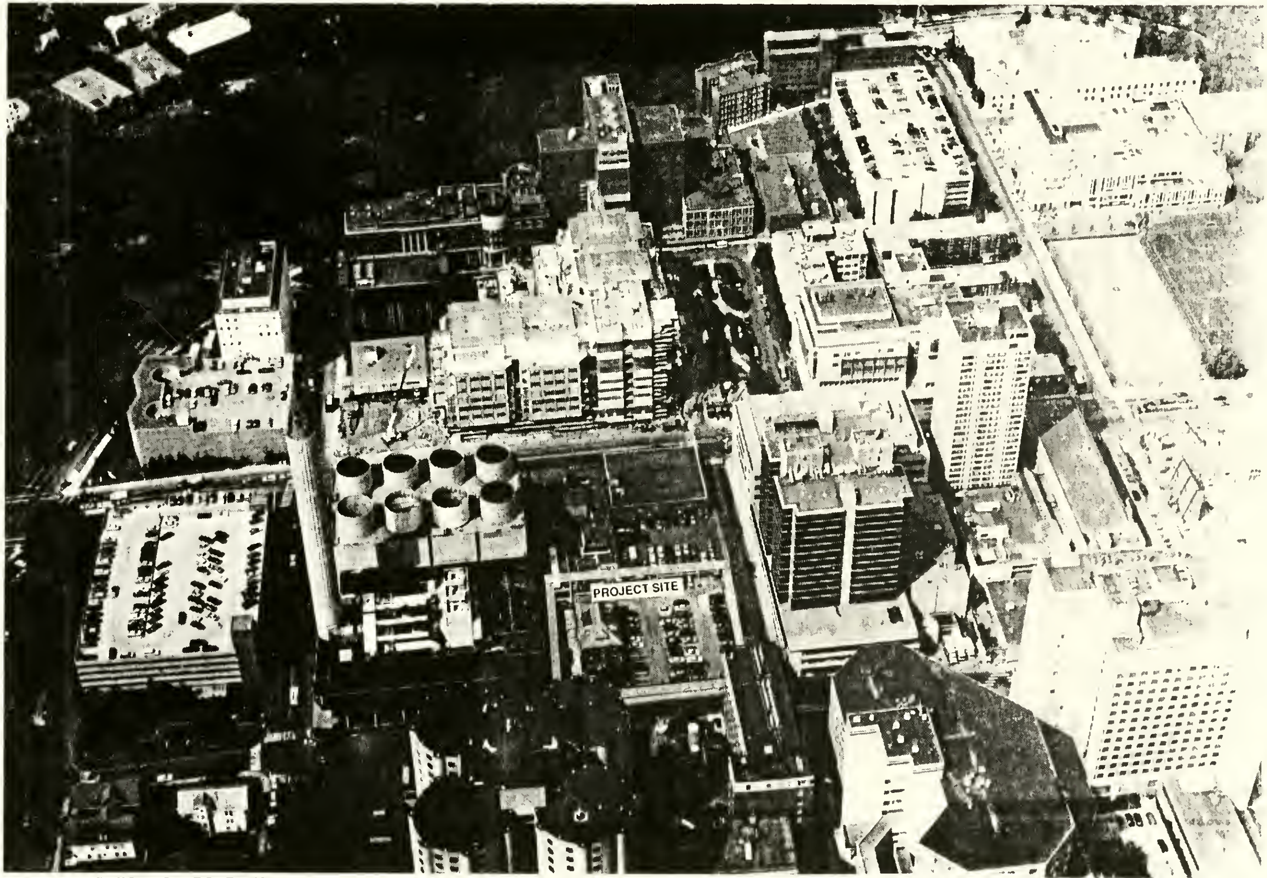

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FIGURE III.2-2
AERIAL PHOTO OF SITE LOOKING NORTHWEST
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3.2 Project Program

Dana-Farber proposes to construct the Smith Research Laboratories at the 65 Deaconess Road site. Figure III.3-1 shows a site plan for the Project. The Project will consist of approximately 213,592 gsf* of space pursuant to the Floor Area Ratio (FAR) definition set forth in the Boston Zoning Code. The building will be 13 stories and will have six below-grade parking levels for 246 cars. The height of the new building will be 184 feet above-grade** plus rooftop mechanical space. Figure III.3-2 shows a section of the proposed development from Binney Street.

The Project will provide facilities that will support the research needs of the Institute. The Project will include space for research, office, research support, and other accessory uses incidental to a research facility (such as, without limitation, loading facilities and storage of hazardous and flammable materials). The cooling tower for the Project's refrigeration plant will be located on the roof. The Project will also include minor modifications to the abutting Dana and Jimmy Fund Buildings which are necessary to connect these buildings to the Smith Research Laboratories.

The program for the research laboratories will provide space for biomedical research to expand investigations in basic tumor biology, mechanisms of cancer, immunology, virology, and AIDS. In addition, it will provide the Institute with space for new directions in the areas of molecular genetics and structural and developmental biology.

The design of the Smith Research Laboratories includes a 2-story arcade along Deaconess Road, notched corners, and additional corner setbacks at the top two floors. This design reduces the perceived mass of the building and improves pedestrian circulation around the site.

The Project will include 11 floors of research, office, and research support space and two floors devoted to mechanical equipment. Dana-Farber will occupy eight floors of research and office space plus the ground floor lobby and five below-grade parking levels. Two research floors, one-half floor of animal space, and one below-grade parking level will be leased to Brigham and Women's Hospital. A summary of the proposed program by floor is provided in Table III.3-1.

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* Approximately 265,000 gsf for MEPA purposes.

** Height is based on an average ground elevation of 43 feet (BCB) and represents the height of the building to the roof line, excluding the parapet.

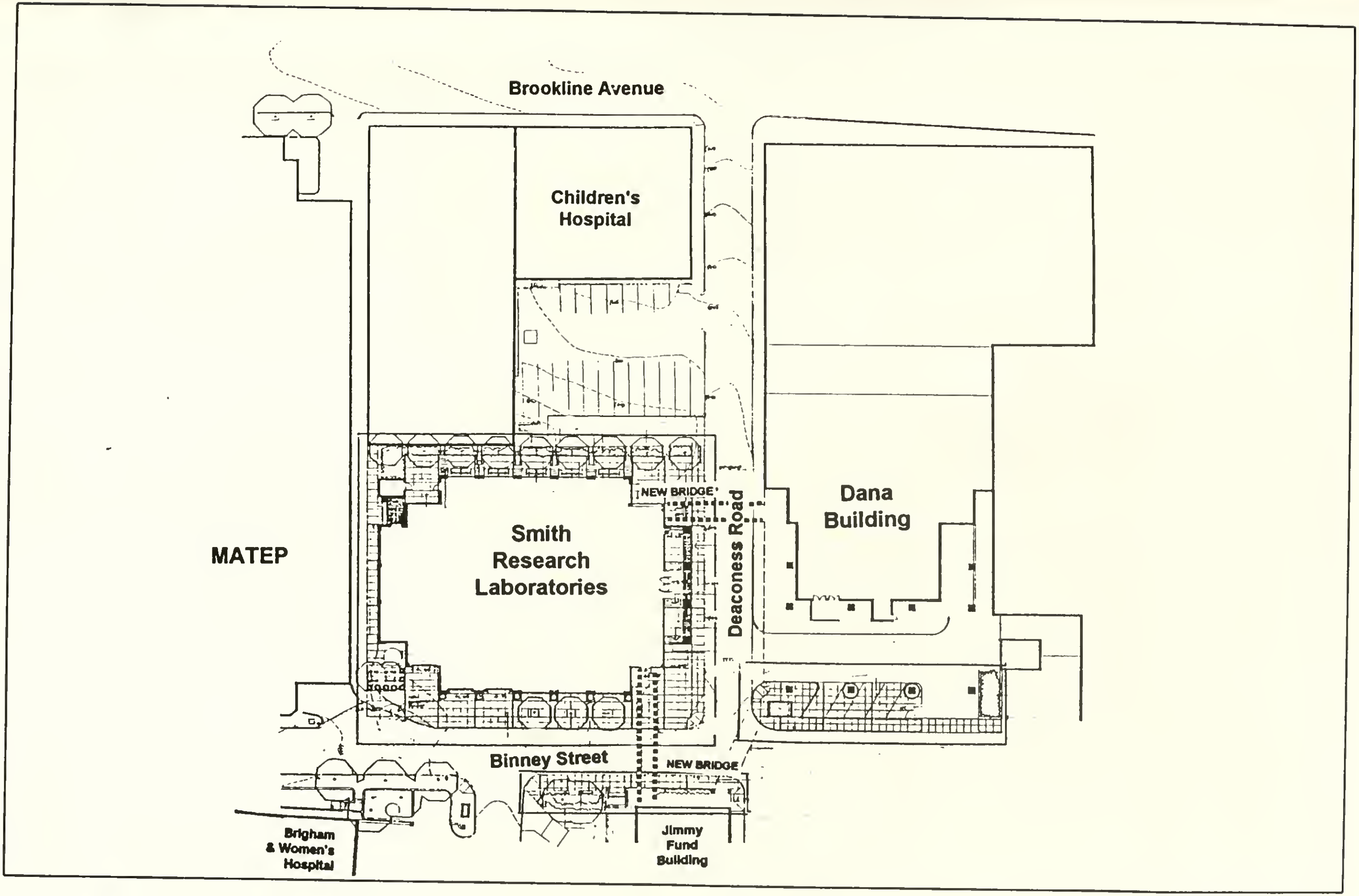

FIGURE III.3-1
SITE PLAN
SMITH RESEARCH LABORATORIES

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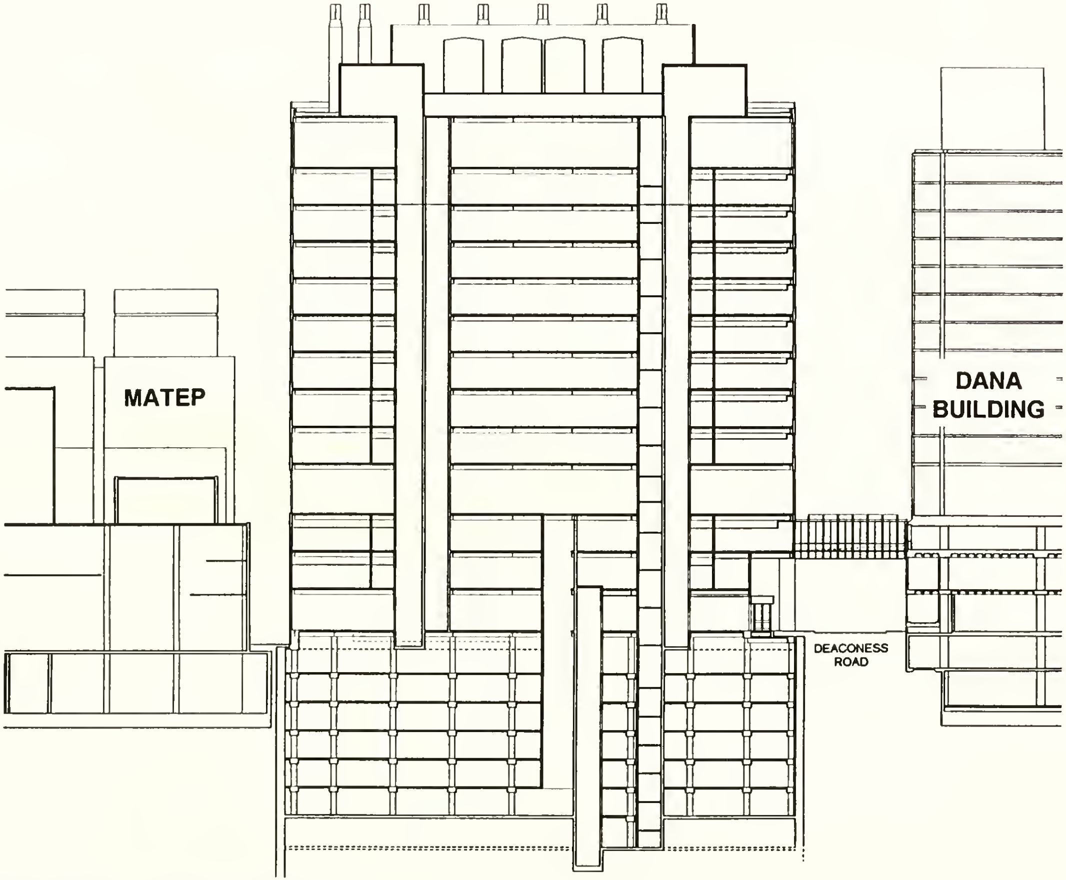

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FIGURE III.3-2
BINNEY STREET SECTION
SMITH RESEARCH LABORATORIES

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Table III.3-1 Proposed Program Summary - Smith Research Laboratories

Floor Level	Proposed Use	Gross Square Feet	FAR Gross Square Feet: Dana-Farber	FAR Gross Square Feet: Tenant	FAR Gross Square Feet: Total
1	Receiving/Mech/Lobby	15,810	13,255	--	13,255
2	Offices	18,480	17,835	--	17,835
3	Research Support	20,489	20,249	--	20,249
4	**Mechanical**	21,215	--	--	--
5	Laboratory	21,215	--	20,489	20,489
6	Laboratory	21,215	--	20,489	20,489
7	Laboratory	21,215	20,489	--	20,489
8	Laboratory	21,215	20,489	--	20,489
9	Laboratory	21,215	20,489	--	20,489
10	Laboratory	21,215	20,489	--	20,489
11	Laboratory	21,215	20,489	--	20,489
12	Laboratory	19,556	18,830	--	18,830
13	**Mechanical**	19,556	--	--	--
PH		1,469	--	--	--
TOTAL		265,080	172,614 gsf	40,978 gsf	213,592 gsf

Parking

Level P6	34 Cars
Level P5	43 Cars
Level P4	43 Cars
Level P3	43 Cars
Level P2	43 Cars
Level P1	40 Cars
TOTAL	246 Cars

The ground floor (Level 1) will contain the entrance to the Smith Research Laboratories, a public lobby, coffee shop, storage, loading and receiving functions and mechanical space (see Figure III.3-3). The main entrance to the building will be from Deaconess Road, although secondary entrances will also be located along the west side of the building and at the corner of Deaconess Road and Binney Street. The Deaconess Road garage access will be located within the ground floor of the building. A small plaza will be developed on the western side of the building, including tree plantings, tables and benches to serve employees. Bicycle racks will be installed in an area adjacent to the garage entrance to encourage this form of transportation to the site. The Project's off-street loading docks will be located off Binney Street and will include three bays completely covered within the first (street) level. One of the bays will be used for the building's dumpster.

Other floor plans for the Project are provided in Figures III.3-4 through III.3-7. The second level will house offices and office support functions. A portion of this level along Deaconess Road will be open to the main lobby below (Figure III.3-4). The third level will house research support functions (Figure III.3-5). This level will also include a new pedestrian bridge connecting to the existing Dana Building over Deaconess Road. In addition, the existing second level bridge at the corner of Deaconess Road and Binney Street, connecting the Dana and Jimmy Fund buildings, will be demolished and replaced by a new bridge over Binney Street connecting the third levels of the Smith Research Laboratories building and the Jimmy Fund Building. These connections are needed to unite cancer research and treatment of the various nearby institutions, and to promote interaction between researchers and clinicians within Dana-Farber. Level 4 will include mechanical space as will the top level (Floor 13). The remainder of the building will be occupied by laboratory research space for Dana-Farber and Brigham and Women's Hospital (Figure III.3-6).

3.3 Parking and Service Areas

The Project will include a 246-space below-grade parking garage on six levels (see Figure III.3-7 for a typical parking plan). Access to the garage will be from Deaconess Road within the ground floor of the building. The garage will replace 58 surface parking spaces located on-site as well 65 spaces being eliminated by ongoing renovations at the Dana Building. Because existing spaces are to be eliminated, there will be a net increase of only 123 spaces on

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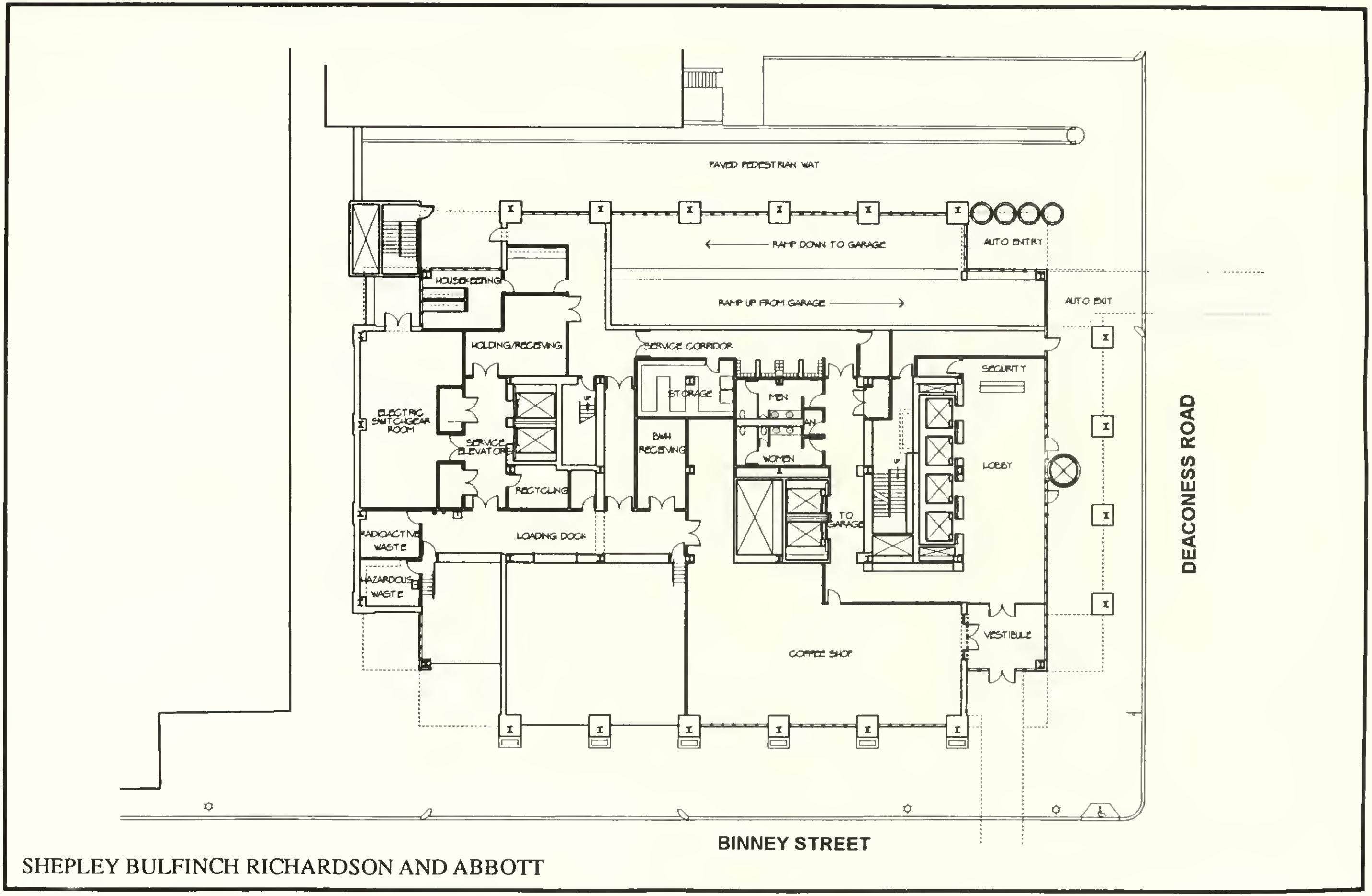

FIGURE III.3-3
GROUND FLOOR PLAN
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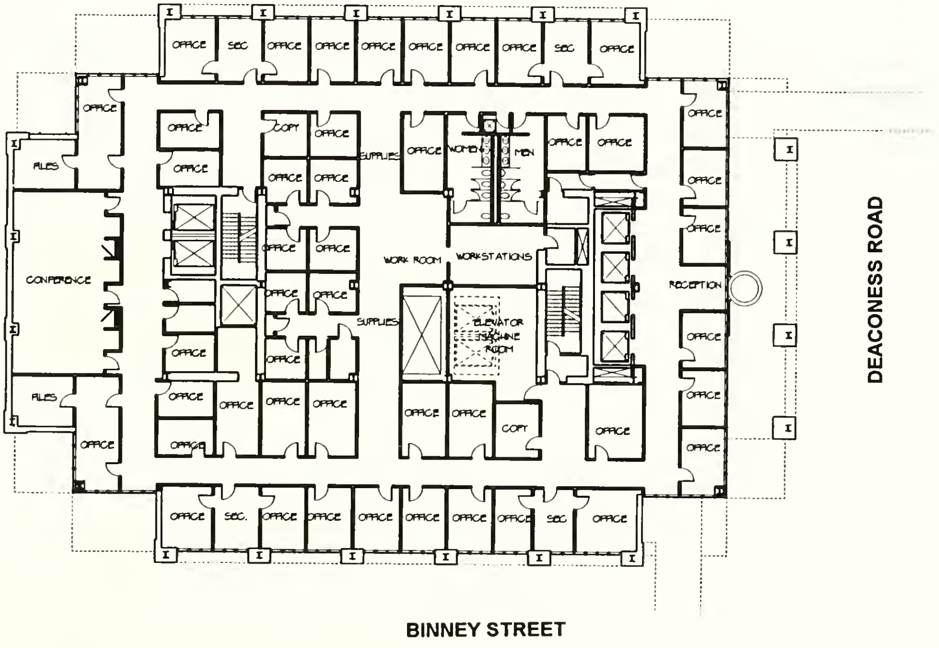

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FIGURE III.3-4
LEVEL 2 FLOOR PLAN
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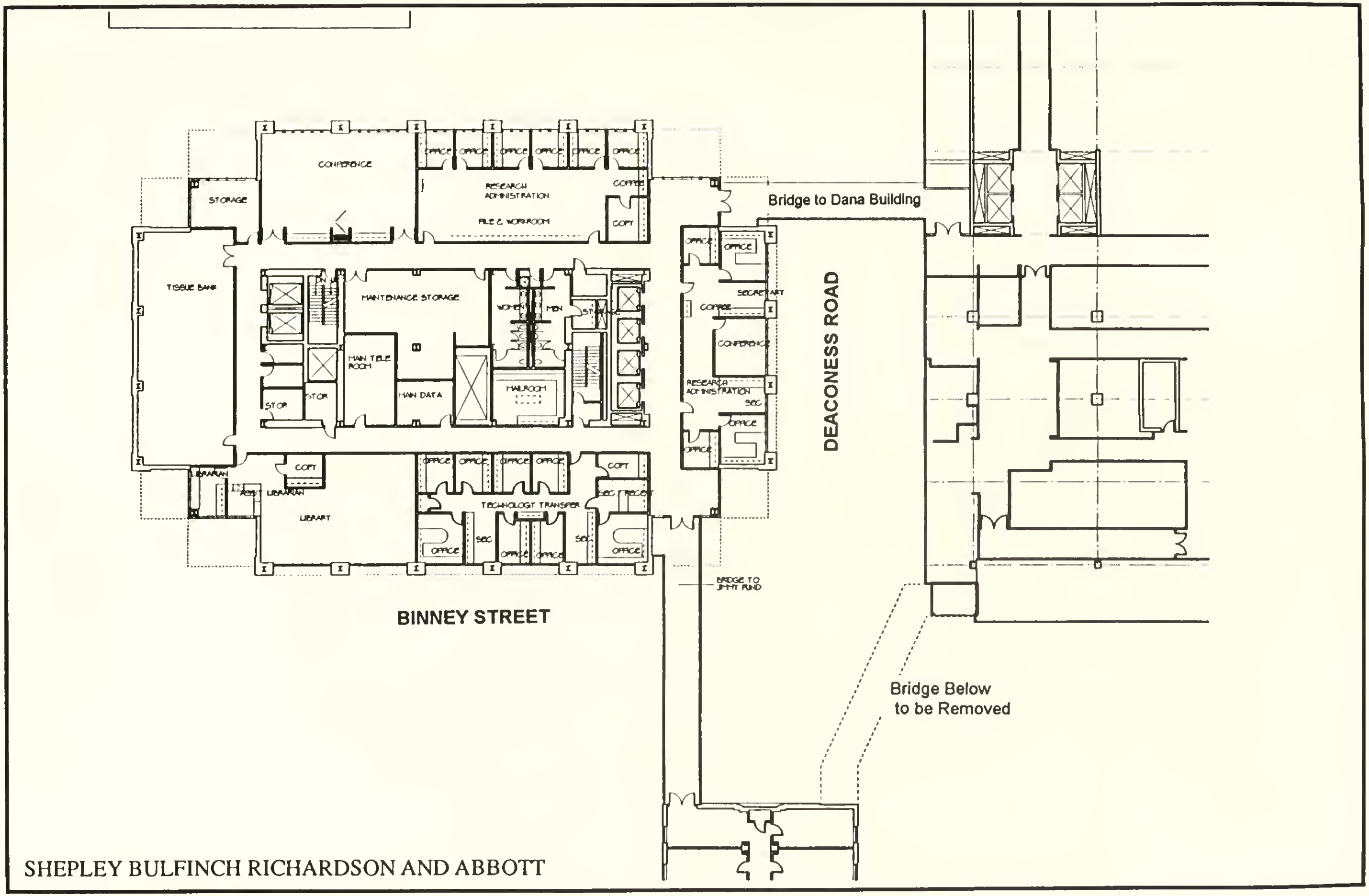

FIGURE III.3-5
LEVEL 3 FLOOR PLAN
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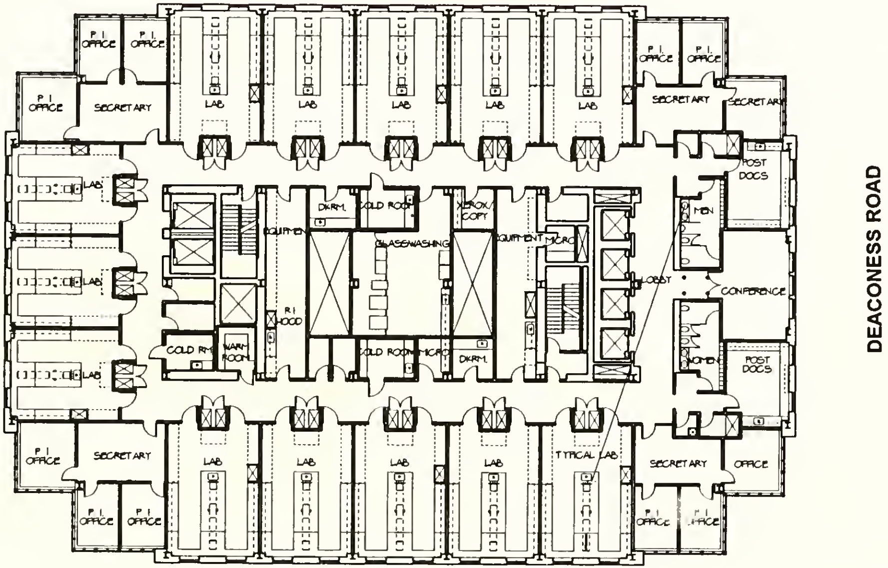

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FIGURE III.3-6
TYPICAL LABORATORY FLOOR PLAN
SMITH RESEARCH LABORATORIES

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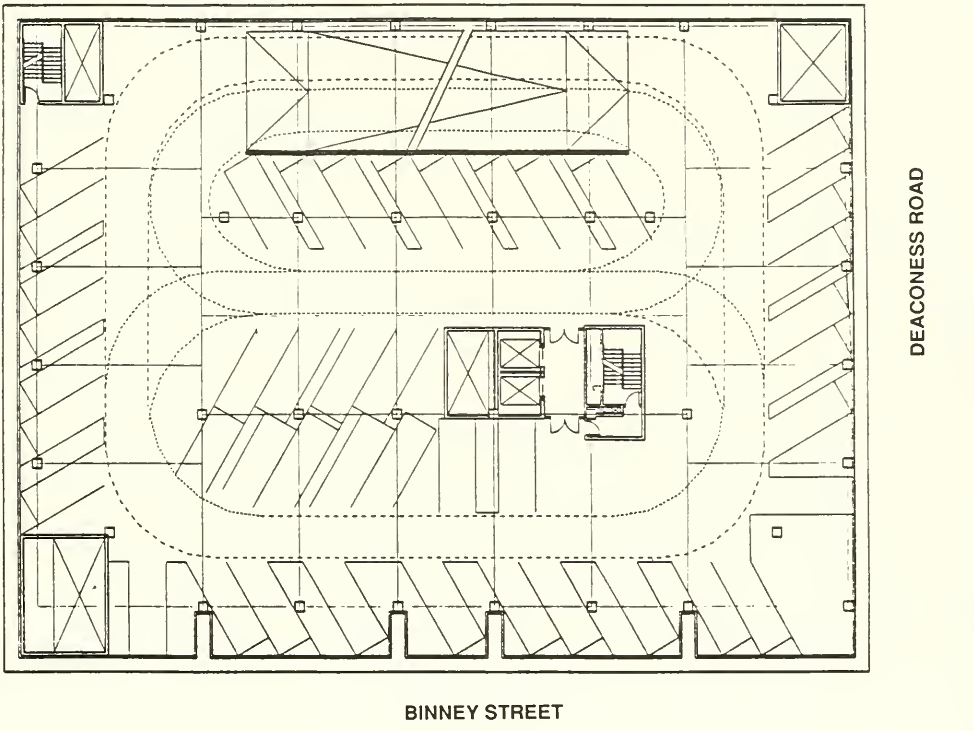

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FIGURE III.3-7
TYPICAL PARKING PLAN
SMITH RESEARCH LABORATORIES

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the Dana-Farber campus following the garage completion. The campus-wide spaces are intended to serve the parking needs of patients, visitors, physicians, and certain other employee groups at Dana-Farber.

The Project's service area including loading docks located on Binney Street, will be covered within the ground floor area. This will ensure that service vehicles will not be visible along Deaconess Road and will not interfere with pedestrian movement along Binney Street. A separate bay for rubbish and recyclables is also included within the service area.

IV. TRANSPORTATION COMPONENT

DANA-FARBER
CANCER INSTITUTE

IV. TRANSPORTATION COMPONENT

The review of the DPIR by the Boston Transportation Department required additional or modified information to be presented in the following areas: traffic/trip generation, parking supply, and mitigation, as summarized below:

- *Traffic/Trip Generation*

  - Use of new employees as the basis for trip generation rates and peak hour trips (see Section 3.1).
  - Specific mitigation to be offered to improve traffic conditions at the Deaconess Road/Brookline Avenue intersection during the AM peak hour in the Build Condition (see Section 4.1.1).

- *Parking Supply*

  - Utilization (assignment) and allocation of parking in the Future Build Condition (see Table IV.3-4).
  - Discussion of new parking demand for the Project in the context of the Institute's existing supply and demand (see Section 3.5).
  - Identify patient/visitor parking demand and address shortfall (see Sections 3.5 and 4.2).

- *Mitigation*

  - Evaluate the effect of proposed mitigation on overall traffic conditions (see Section 4.1.1).

The Secretary's Certificate on the DEIR requested additional information on mitigation to be provided in the FEIR, as summarized below:

- Analysis that demonstrates level of service (LOS) improvement expected at signalized intersections (see Section 4.1.1).

- Summary of the types of improvements being considered by MASCO (see Appendix D, May 12, 1994 letter from MASCO).

- Analysis of particular locations showing LOS declines, such as at Brookline Avenue and Deaconess Road (see Section 4.1.1).

- Range of mitigation measures that could be implemented to prevent further decline in LOS and Dana-Farber's role in this mitigation (see Section 4.1.1).

- Analysis that examines average delay for vehicles traveling on main line roadways through the LMA and address MBTA comment letter (see Comment 1.8 of Chapter IX).

- Present management reduction strategies that adjust parking rates and discusses impacts on demand (see Section 4.2).

- Compare mode splits by employees at Dana-Farber with other LMA projects (see Comment 1.11 of Chapter IX).

- Discuss whether trip generation rates were based on square footage or employees, and the differences in the conclusions (see Section 3.1).

- Provide daily trip estimates (see Table IV.3-1).

- Discuss consistency of trip rates between institutions in the LMA (see Comment 1.11 of Chapter IX).

- Goal of FEIR should be to consider ways to achieve higher non-vehicle trip rates and develop a monitoring mechanism to maintain these higher rates post-project occupancy (see Section 4.0).

- Organize a meeting in near future to discuss long-range infrastructure and goals for the LMA area (see Appendix D, letter from MASCO).

This transportation analysis and that of the DPIR/DEIR form the basis for a Transportation Access Plan (TAP), and TAP Agreement which Dana-Farber will enter into with the Boston Transportation Department (BTD). This Agreement is currently being negotiated with BTD and will be finalized shortly.

The information presented in this chapter includes revisions needed since the filing of the DPIR/DEIR, and the additional information needed to address the BRA's PAD and the Secretary's Certificate. Some information contained in the DPIR/DEIR has not been reprinted, if no outstanding issues remained to be addressed.

1.0 EXISTING CONDITIONS

1.1 Traffic Study Area

The Project study area, which was developed in consultation with BTD, BRA, and MEPA, is shown in Figure IV.1-1. Three major arterials (Longwood Avenue, Brookline Avenue and the Riverway) and local streets (Francis Street, Binney Street and Deaconess Road) service the site.

1.2 1993 Existing Traffic Volumes

Six intersections have been analyzed as part of the DPIR/DEIR and the FPIR/FEIR. These include:

	Location	Status
1)	Brookline Avenue at the Riverway	Signalized
2)	Francis Street at Binney Street	Unsignalized
3)	Brookline Avenue at Francis Street	Signalized
4)	Brookline Avenue at Deaconess Road	Signalized
5)	Longwood Avenue at Binney Street	Unsignalized
6)	Brookline Avenue at Longwood Avenue	Signalized

Traffic volume data for the six study area intersections was obtained from two sources. Data for all but the intersections of Brookline Avenue at Longwood Avenue, and Brookline Avenue at the Riverway were obtained by HMM through manual traffic counts conducted in July and August, 1993. These turning movement counts were taken during the 7:00 to 9:00 AM, and the 4:00 to 6:00 PM weekday peak traffic hours. Manual counts for the two remaining intersections were obtained from MASCO.* All traffic data collected was previously included in Appendix C of the DPIR/DEIR.

HMM's traffic engineers balanced the intersection volumes where possible. Adjacent intersections having numerous mid-block driveways or garage entrances were not balanced. This method of balancing was used so that

* MASCO, counts performed in February 1993.

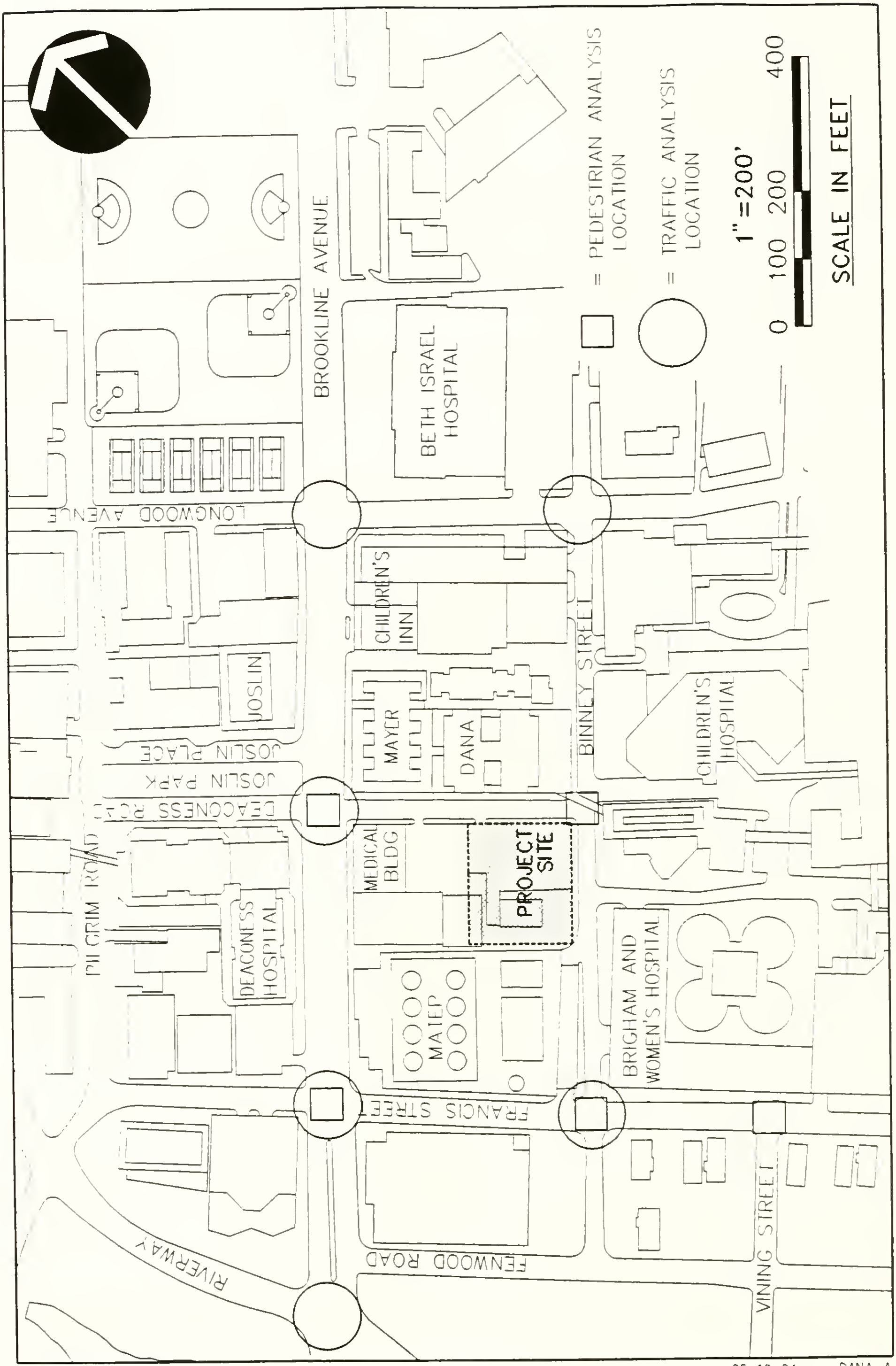

FIGURE IV.1-1
TRAFFIC STUDY AREA
SMITH RESEARCH LABORATORIES

vehicle flows from one location to the next could be verified. Figures IV.1-2 and IV.1-3 show the 1993 Existing AM and PM traffic volumes during the peak hour.

1.3 1993 Existing Traffic Operations

Traffic operations were analyzed according to standard procedures and practices outlined in the 1985 Highway Capacity Manual. The efficiency of traffic operations at a location (or changes in traffic operations), is measured in terms of Level of Service (LOS). The LOS refers to the quality of traffic flow along roadways and at intersections. It is described in terms of Levels A through F; where A represents the best possible free-flow traffic conditions, and F represents congested, forced-flow or failing conditions. These measures are discussed briefly below, and Table IV.1-1 summarizes their interrelationships.

At signalized intersections, LOS is defined in terms of average approach delays (measured in seconds). Average delay measures the mean stopped delay experienced by vehicles entering a signalized intersection during the peak hour period. Average delay is measured for each individual approach and for the intersection as a whole. The LOS deteriorates as average delays increase.

At unsignalized intersections, LOS is defined in terms of reserve capacity. The reserve capacity is the unused capacity of an approach lane(s) to an intersection. This measure, defined as passenger cars per hour, indicates how many more vehicles would be required to bring the intersection approach lane(s) to capacity. The LOS deteriorates as reserve capacity values decrease.

Table IV.3-2 shows the 1993 AM and PM Existing LOS for the six study area intersections analyzed.

During 1993 conditions, four of the six intersections operate at LOS E or worse during at least one of the two peak hours. At the signalized intersections, Brookline Avenue at Riverway operates at LOS F during both AM and PM peak hours. Brookline Avenue at Francis Street operates at LOS E during the AM peak hour. The two remaining signalized intersections operate at LOS C or better for both AM and PM peak hours.

At the unsignalized intersections, all southbound movements onto Francis Street from Binney Street operate at LOS E during the PM peak hour. Turns from Binney Street onto Longwood Avenue operate at LOS E and LOS F

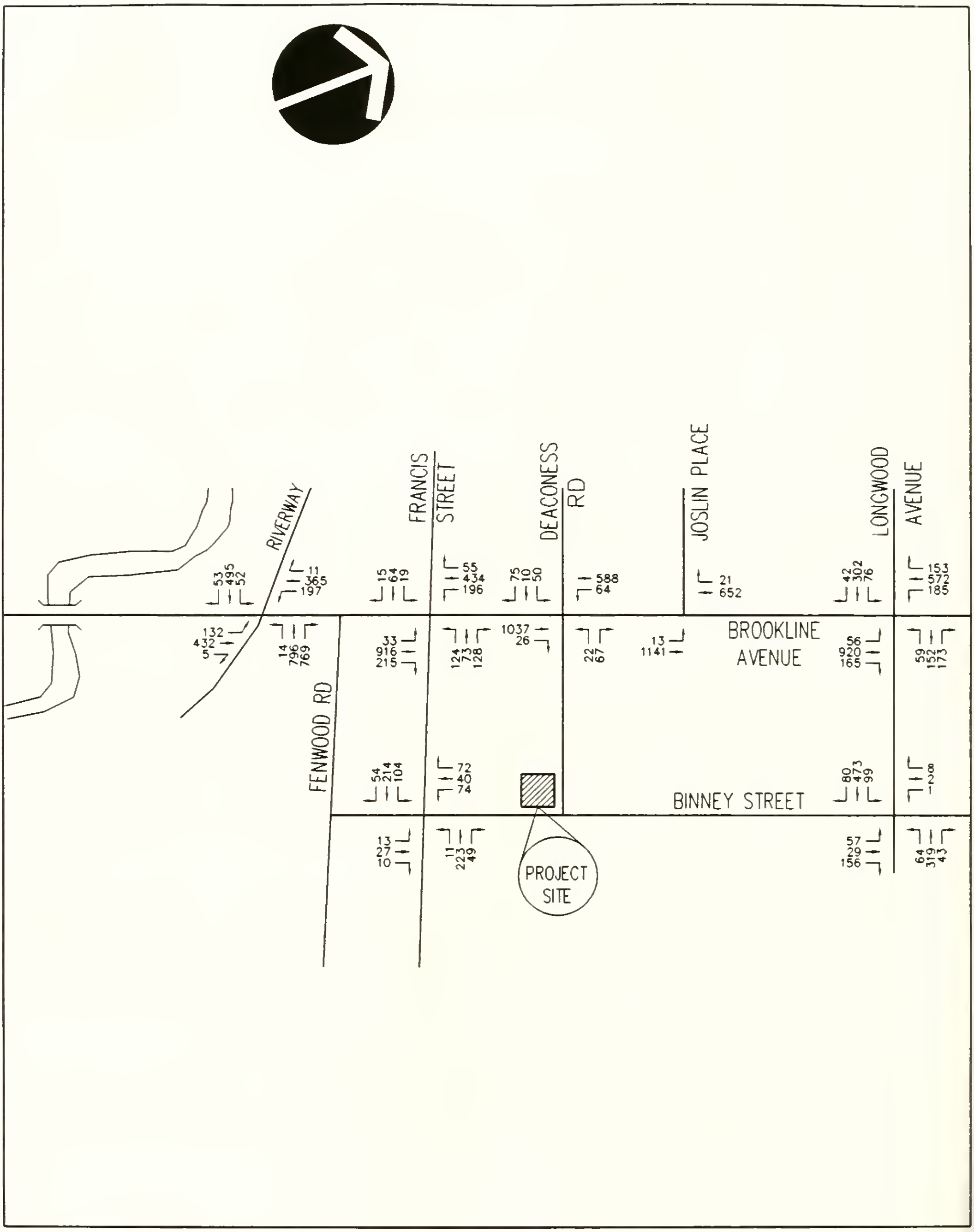

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FIGURE IV.1-2
1993 EXISTING AM PEAK HOUR TRAFFIC VOLUMES
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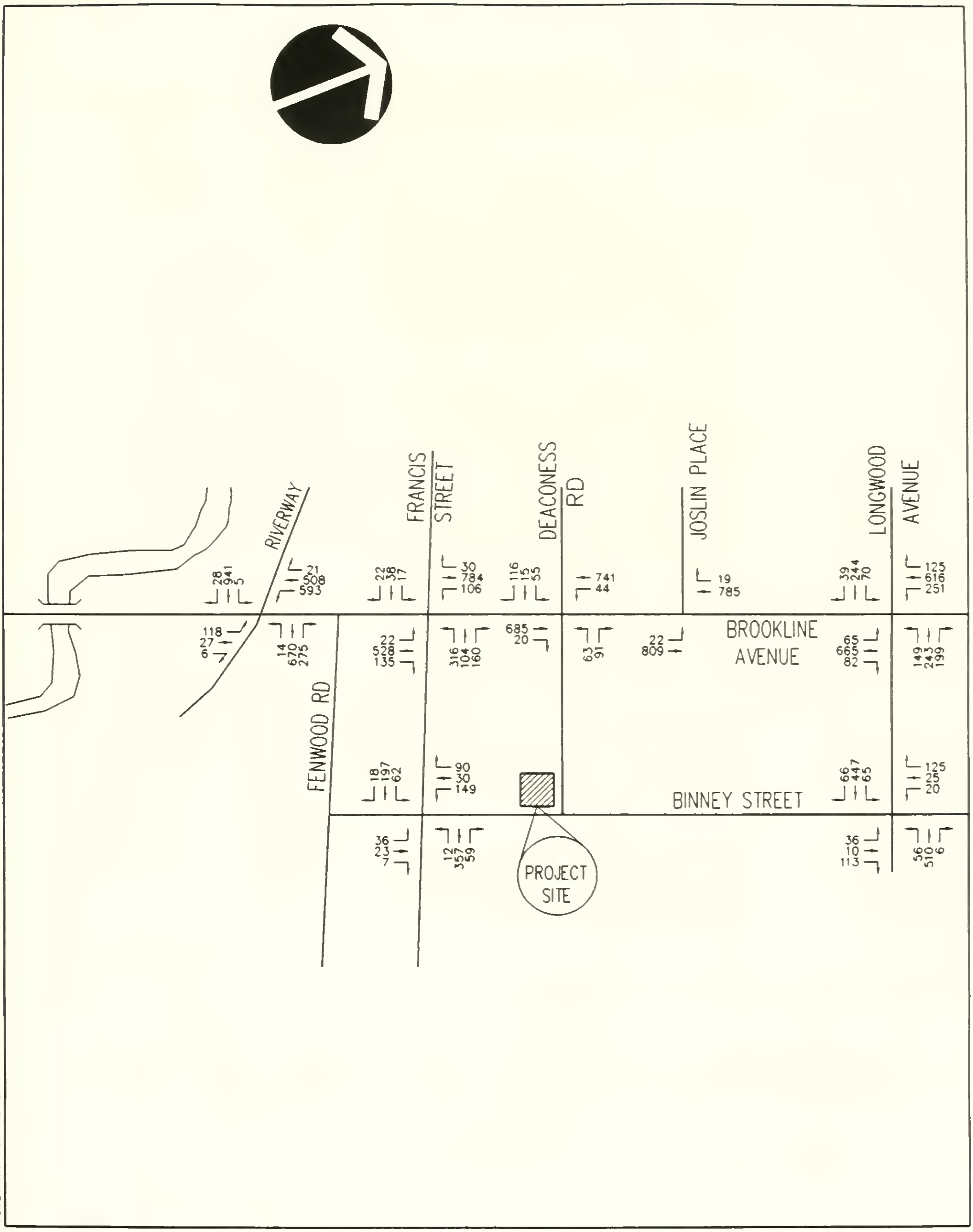

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FIGURE IV.1-3
1993 EXISTING PM PEAK HOUR TRAFFIC VOLUMES
DANA-FARBER CANCER INSTITUTE

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Table IV.1-1 Level of Service (LOS) Designations*

Category	Description	Delay Range** (Seconds/ Vehicle)	Reserve*** Capacity (Vehicles/ Hour)
LOS A:	Describes a condition of free flow, with low volumes and relatively high speeds. There is little or no reduction in maneuverability due to the presence of other vehicles, and drivers can maintain their desired speeds with little or no delay.	0.00-5.0	400+
LOS B:	Describes a condition of stable flow, with desired operating speeds relatively unaffected, but with a slight deterioration of maneuverability within the traffic stream.	5.1-15.0	300-399
LOS C:	Describes a condition still representing stable flow, but speeds and maneuverability begin to be restricted. The general level of comfort begins to deteriorate noticeably at this level.	15.1-25.0	200-299
LOS D:	Describes a high-density traffic condition approaching unstable flow. Speeds and maneuverability become more seriously restricted, and the driver experiences a poor level of comfort.	25.1-40.0	100-199
LOS E:	Represents conditions at or near the capacity of the facility. Flow is usually unstable, and freedom to maneuver within the traffic stream becomes extremely difficult.	40.1-60.0	0.99
LOS F:	Describes forced flow or breakdown conditions with queuing along critical approaches. Operating conditions are highly unstable as characterized by erratic vehicle movements along each approach.	60.1 or greater	N/A

* Source: Transportation Research Board, Highway Capacity Manual, Special Report 209, 1985.

** Delay ranges relate to the mean stopped delay incurred by all vehicles entering the intersection and do not consider the effects of traffic signal coordination. This criteria is intended for use in the evaluation of signalized intersections.

*** Reserve capacity refers to the unused capacity of the minor approach, on a per-lane basis. This criteria is limited to use in the evaluation of unsignalized intersections.

during the AM peak hour and LOS E during the PM peak hour. The remaining unsignalized intersection movements operate at LOS D or better during both AM and PM peak hour.

1.4 1993 Existing Trip Characteristics

Existing modal share data for the Institute's employees were identified from part of the Institute's Draft Commuter Mobility Work Plan.* As part of the initial planning for the Work Plan, the Institute distributed a transportation survey to its employees in December 1989. The purpose of the survey was to provide CommuteWork, the Transportation Management Organization for the LMA, with information about employee commuting habits.

As Table IV.1-2 shows, the employee survey indicated that the majority of employees (53%) commute by driving alone. This is consistent with the results of a similar survey of New England Deaconess Hospital employees. The remaining employees use alternative modes of travel such as public transit (30%), carpool (rideshare) (9%), walking/bicycle (5%), MASCO shuttle (2%), or vanpools (1%).

Table IV.1-2 Modal Share

Mode	Percent Use
Single Occupant Auto	53%
Rideshare	9%
MBTA Rapid Transit	15%
MBTA Bus	10%
MBTA Commuter Rail	5%
Vanpool	1%
Walk/Bicycle	5%
MASCO Shuttle	2%
TOTAL	**100%**

1.5 Parking Conditions

1.5.1 On-Street Parking

An on-street parking study was completed as part of the DPIR/DEIR. This study included an evaluation of curb-side parking spaces along Brookline Avenue, Francis Street, Autumn Street and Pilgrim Road.

* Draft Commuter Mobility Plan, Dana-Farber Cancer Institute, 1990.

As shown in Appendix C of the DPIR/DEIR, the highest number of turnovers occurred along Brookline Avenue and Francis Street, while the lowest occurred along Autumn Street and Pilgrim Road.

1.5.2 Dana-Farber Parking

The Institute controls 196 spaces on-campus; 138 at the Dana Building Garage and 58 at the Frederika (Project Site) surface lot. However, the Frederika spaces will be lost due to construction of the Smith Research Laboratories. The total number of spaces at the Dana Building represent a recent loss of 65 spaces due to the on-going clinical space renovation project. The employees who parked in those Dana spaces have been reassigned to off-campus parking. The 123 total spaces lost will be replaced with construction of the proposed garage. Within the LMA, the Institute utilizes a total of 218 off-site spaces at three locations including MASCO's Servicenter and 375 Longwood Avenue garages and Blackfan Street surface parking lot. Figure IV.1-4 identifies the Institute's parking facilities. The Institute also utilizes 326 parking spaces outside the LMA. Table IV.1-3 shows the employee parking assignments for all 740 parking spaces used by the Institute.

Based upon the Commuter Mobility Study and parking data discussed above, a parking supply versus demand analysis was performed to determine existing parking deficiencies, if any, at the Institute. Table IV.1-4 shows the results of the existing parking analysis. Based upon an auto mode split of 62% (single occupant and rideshare), an auto-occupancy rate of 1.09 and a turnover rate of 1.0, the employee demand is for 734 long-term parking spaces. Visitor/patient parking demand was calculated based on an assumed 95% auto mode split, an auto-occupancy rate of 1.0 and a turnover rate of 1.8 (see Table IV.1-4). Using this information, the visitor/patient demand is for 95 short-term parking spaces. This results in a total demand of 829 parking spaces. Therefore, during existing conditions the demand exceeds supply by 89 parking spaces.

The current monthly employee cost for parking ranges from $47/month off-site (Wentworth and Kenmore) to $95/month on-campus (Dana) and within the LMA. The existing parking rate structure is shown on Table IV.1-5. According to MASCO* the average cost for employee parking within the LMA ranges from $63 to $135 per month. Dana-Farber's parking rate structure is in the middle of that range and is therefore reflective of other

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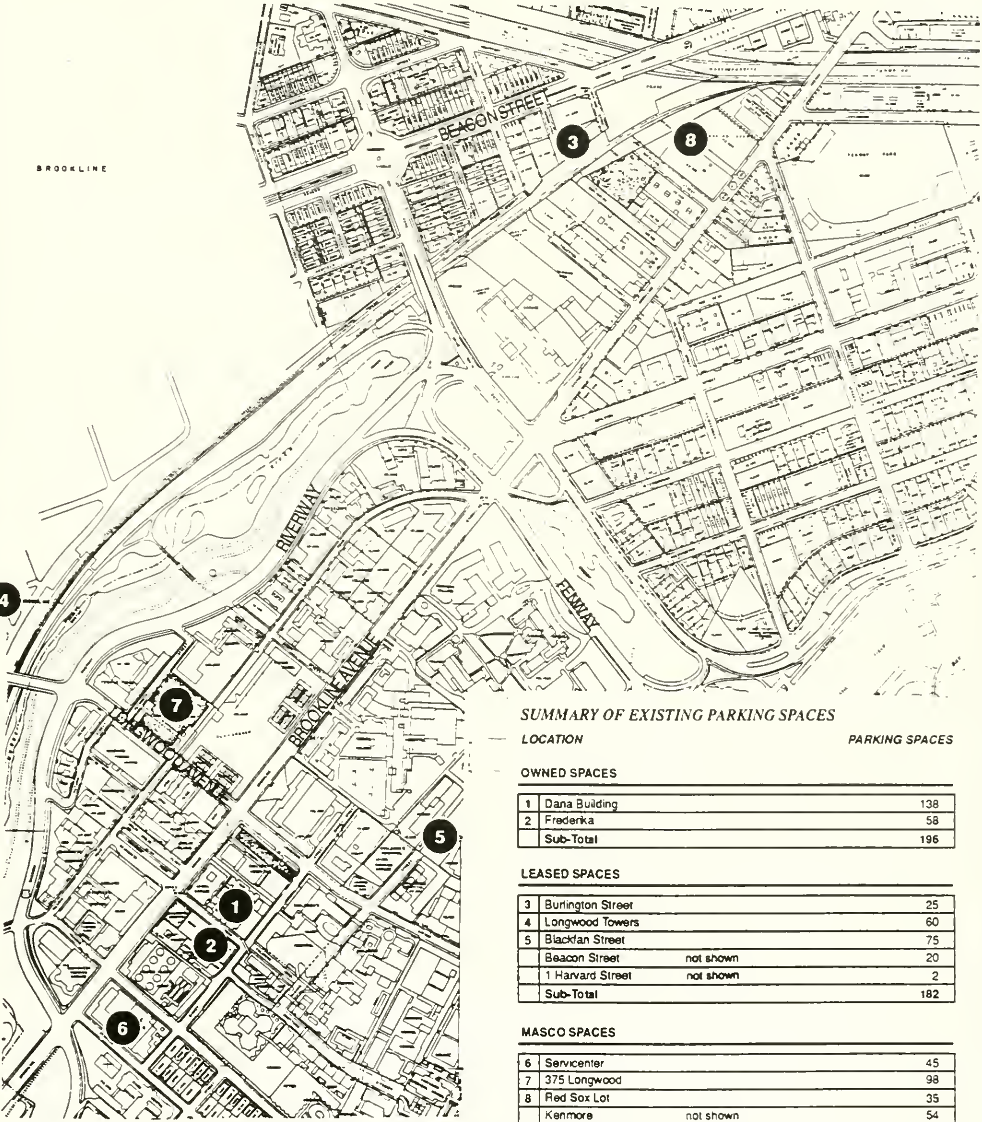
* Telephone conversation with MASCO staff, October 27, 1993.



SUMMARY OF EXISTING PARKING SPACES

	LOCATION		PARKING SPACES
	OWNED SPACES		
1	Dana Building		138
2	Frederika		58
	Sub-Total		**196**
	LEASED SPACES		
3	Burlington Street		25
4	Longwood Towers		60
5	Blackfan Street		75
	Beacon Street	not shown	20
	1 Harvard Street	not shown	2
	Sub-Total		**182**
	MASCO SPACES		
6	Servicenter		45
7	375 Longwood		98
8	Red Sox Lot		35
	Kenmore	not shown	54
	Lansdown Street	not shown	80
	Wentworth	not shown	50
	Sub-Total		**362**
	TOTAL PARKING SPACES		**740**

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FIGURE IV.1-4
OFF-STREET PARKING LOCATIONS
DANA-FARBER CANCER INSTITUTE

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Table IV.1-3: Existing Dana-Farber Cancer Institute Parking Assignments

Facility	Location	Ownership	Total Spaces	Physicians	Researchers	Nurses	Other Medical Staff	Others	Visitors/ Out-patients
1. Dana Building (4th & 5th Floor)	On-Campus	Dana-Farber	138[1]	21	10	2	1	5	99
2. Frederika Lot	On-Campus	Dana-Farber	58[2]	22	9	0	6	21	0
3. Burlington Street	Nearby	Lease	25	0	25	0	0	0	0
4. Longwood Towers	Nearby	Leased	60	1	5	11	13	30	0
5. Blackfan Street	Within LMA	Lease	75	25	24	2	11	13	0
6. Servicenter	Within LMA	MASCO	45	11	3	16	6	9	0
7. 375 Longwood Avenue	Within LMA	MASCO	98	30	19	12	13	24	0
8. Red Sox Lot	Nearby	MASCO	35	0	13	3	11	8	0
9. Beacon Street	Nearby	Leased	20	0	0	0	0	20	0
10. 1 Harvard Street	Outside	Leased	2	0	0	0	0	2	0
11. Kenmore	Nearby	MASCO	54	0	16	9	8	21	0
12. Lansdowne Street	Nearby	MASCO	80	0	42	4	11	23	0
13. Wentworth	Nearby	MASCO	50	0	9	1	10	30	0
TOTAL			**740**	**110**	**175**	**60**	**90**	**206**	**99**

1 Originally 203 spaces but lost 65 spaces on 5th floor to renovations.

2 Losing all 58 spaces for the Smith Research Laboratories Project.

Table IV.1-4: Existing Parking Supply and Demand
Dana-Farber Cancer Institute

	Employees						Visitors/Patients							
Year	Full Time Day Employees[1]	Auto Mode Split	Auto Occupancy	Daily Autos (One Way)	Daily Turnover Rate (Utilization)	Employee Parking Demand (Long Term)	Daily Visitors/ Outpatients[2]	Auto Mode Split	Auto Occupancy	Daily Autos (One Way)	Turnover Rate (Utilization)	Short Term Parking Demand	Total Parking Demand	Total Parking Supply
1993	1,290	62%	1.09	734	1.0	734	180	95%	1.0	171	1.8	95	829	740

1 There are 1,843 employees, 70% working the day-shift.

2 Based upon 35,924 outpatients averaged over 200 days in 1992. Outpatients increase by 5% annually.

Table IV.1-5 Existing Parking Rate Structure

Parking Facility	Monthly Rate
Dana Building	$95.00
Frederika Lot	89.00
Other LMA Garages/Lots	95.00
Outside LMA Garages/Lots	$47.00-54.00

institutions. The Institute's $47 to $54 range for lots outside the LMA are on the low end of MASCO's average cost of $50 to $70. This provides and incentive to employees looking for lower parking costs, and therefore helps reduce the parking demand within the LMA.

It should be noted, however, that off-campus parking is currently leased on a monthly basis due to current market conditions. In order to remedy the continuous search for safe satellite parking, MASCO is searching to identify a location, or locations, that can be developed for permanent centralized parking.

The Dana-Farber policy on visitor/patient parking is designed to provide convenient, safe, low-cost parking at the on-campus garage. A discount on the maximum garage charge is available to all patients and their families.

1.6 Transit

Although the existing city-wide public transit system servicing the LMA is a vital component of the overall transportation system, its breadth and quality of service is limited compared with other major employment centers in downtown Boston. As shown in Table IV.1-2, 30% of the Institute's employees utilize public transportation. Improved transit service would be welcome because the LMA is Boston's largest employment center outside of the downtown area.

An additional 2% of Dana-Farber employees ride the Metrobus (MASCO shuttle). Metrobus, a subsidiary of MASCO, operates bus routes that provide fixed-route service to communities outside the LMA for affiliates of LMA institutions. See Figure IV.1-5 in the DPIR/DEIR for all transit and bus routes in the LMA.

2.0 1998 NO-BUILD CONDITIONS

The design year for this analysis is 1998 (in accordance with MEPA's 5-year forecast requirement). Forecasts of vehicular traffic for this design year takes into account traffic due to two sources: background traffic growth and traffic generated by other proposed developments in the area.

2.1 Background Traffic Growth

The background traffic growth rate was based upon two data sources. The first source was the *LMA Transportation Study* prepared for MASCO by Vanasse Hangen Brustlin, Inc. (VHB), in November 1987. The LMA Study's background traffic growth rate was 0.5% per year. This rate was based upon employment forecasts for Boston, Cambridge and Brookline.

The second data source was the Beth Israel Hospital's New Clinical Center and Research North, *Final Project Impact Report (FPIR)* prepared by VHB in November 1992. The AM/PM peak hour manual counts in 1987 were compared to the AM/PM peak hour manual counts taken by VHB in 1991 and 1992.

After reviewing the above data sources, and discussing the results with MASCO and BTD, a background traffic growth rate of 1.0% per year was selected. This rate has also been used for the recently approved New England Deaconess Hospital Research Facility FPIR/FEIR (EOEA #8776). This traffic growth rate is applied to all through-traffic movements on each arterial studied.

2.2 Other Development Traffic

Table IV.2-1 lists proposed development projects that are under construction or approved within the Project study area. The BRA and BTD requested that each of these projects be included in the No-Build analysis for the Project. Traffic conditions in the year 1998 were evaluated with the inclusion of these other developments (i.e., development independent of the Project). The trip generation for the other developments was obtained from the data sources cited in Table IV.2-1.

2.3 1998 No-Build Traffic Volumes

The combined background traffic growth and traffic from other developments were distributed throughout the study area roadway network in order to evaluate the 1998 No-Build traffic conditions. The vehicle trips from the other developments under construction or approved within the study area were

Table IV.2-1 Other Developments Under Construction or Approved within the Study Area

	Development Name	Proposed Land Use(s)	Expected Completion Year
1.	Joslin Diabetes Center	Research & Clinical Facility 84,230 SF	1994
2.	Brigham & Women's Hospital	Center for Women and Newborns 203,000 SF	1994
3.	New England Deaconess Hospital	Clinical Facility (Patient Care, Treatment Facilities) 330,000 SF	1994
		Research Facility 295,000 SF	1997
4.	Beth Israel Hospital	Clinical Center (Medical, Retail, Clinical) 385,000 SF 700-710 space garage 172,000 SF	1995
		Research North (Research) 110,000 SF	1996
5.	Massachusetts College of Pharmacy and Allied Health Sciences	Research and Academic 172,000 SF	1998
6.	Harvard Institutes of Medicine	Biomedical Research 294,300 SF	1998

Sources:

1. *Joslin Diabetes Center, Research and Clinic Facility - FPIR,* Ellenzweig Associates, Inc., September 1991.
2. Brigham and Women's Hospital, *Clinical Support Facility - Transportation Access Plan - FPIR*, Vanasse Hangen Brustlin, Inc., July 1991.
3. NEDH-Clinical Facility, HMM Associates, Inc., January, 1991. NEDH Research Facility, FPIR/FEIR, February 1994.
4. Beth Israel Hospital, *Clinical Center and Research North, FPIR*, VHB, Inc., November 1992.
5. Massachusetts College of Pharmacy and Allied Health Sciences Project, *FPIR/FEIR*, HMM Associates, Inc., June 1993.
6. Harvard Institute of Medicine, *Draft Environmental Impact Report*, Vanasse Hangen Brustlin, Inc., September, 1993.

extended as through traffic entering and exiting the major roads near the site. The inclusion of the 1.0% background growth rate with these other development vehicle trips resulted in the 1998 No-Build traffic volumes. The 1998 AM and PM No-Build traffic volumes are shown on Figures IV.2-1 and IV.2-2.

2.4 1998 No-Build Traffic Operations

Using the No-Build traffic volumes, an analysis of peak hour traffic operations for 1998 conditions without the Project was conducted. The results of this analysis are presented in Table IV.3-2. At the four signalized intersections, there are three changes in LOS. During the AM peak hour, the LOS B at the Brookline Avenue/Deaconess Road intersection drops to LOS C, which is still better than average. However, during the same time period at the Brookline Avenue/Francis Street intersection level of service declines from LOS E under existing conditions to LOS F. For the two unsignalized intersections, the LOS D and E currently existing at the Binney Street/Francis Street intersection during the PM peak hour, decline to LOS E and F. In addition, as part of its Clinical Center, Beth Israel Hospital has committed to signalization of the Binney St./Longwood Avenue intersection. This will result in LOS C during AM and LOS B in the PM. Both Binney Street approaches to Longwood Avenue will operate at LOS F during the PM. All LOS calculations were contained in Appendix C of the DPIR/DEIR.

3.0 1998 BUILD CONDITIONS

3.1 Trip Generation

Vehicle trips to and from a site can be estimated by several means. The standard option, which is the one required by the EOEA/EOTC Guidelines, is to use data published by the Institute of Transportation Engineers (ITE) in the manual entitled Trip Generation (5th Edition, 1991). This publication contains trip generation rates for a wide variety of land uses. These vehicle trip rates are obtained from nationwide studies and are normally suitable for design purposes. The result is a very conservative estimate, particularly when applied to a facility such as this where the increase in square footage represents relocation of existing facilities as well as new facilities.

The Project calls for the construction of 265,000 gross square feet (gsf) of research space with 420 new employees. This represents a decrease of 23,000 gsf from the DPIR/DEIR project. New trip generation calculations have been completed to reflect this decrease. ITE Land Use Code 760 (Research Center) was utilized. The resultant trip generation estimates are provided in Table IV.3-1. The trip generation estimates based on square footage are

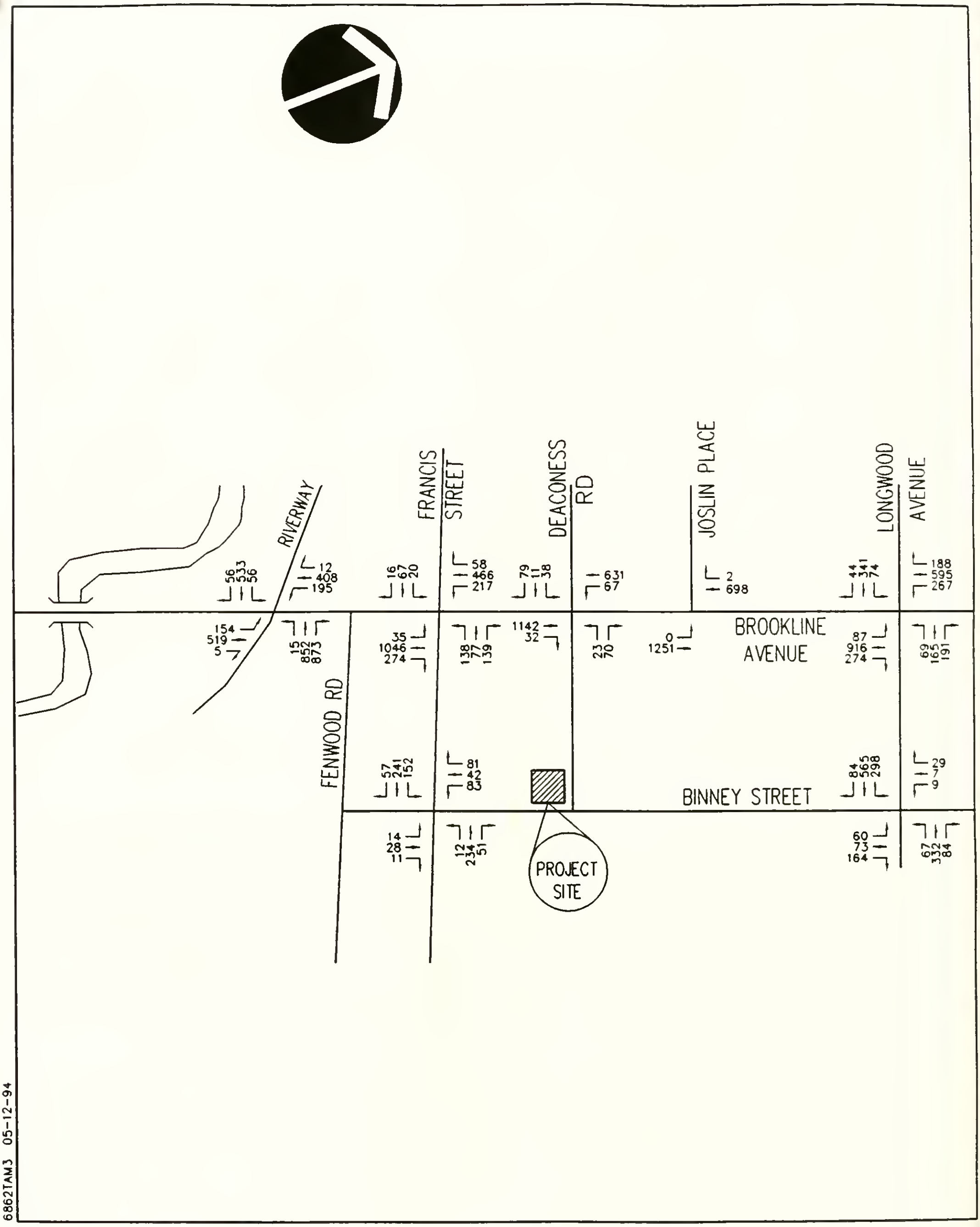

FIGURE IV.2-1
1998 NO BUILD AM PEAK HOUR TRAFFIC VOLUMES
DANA-FARBER CANCER INSTITUTE

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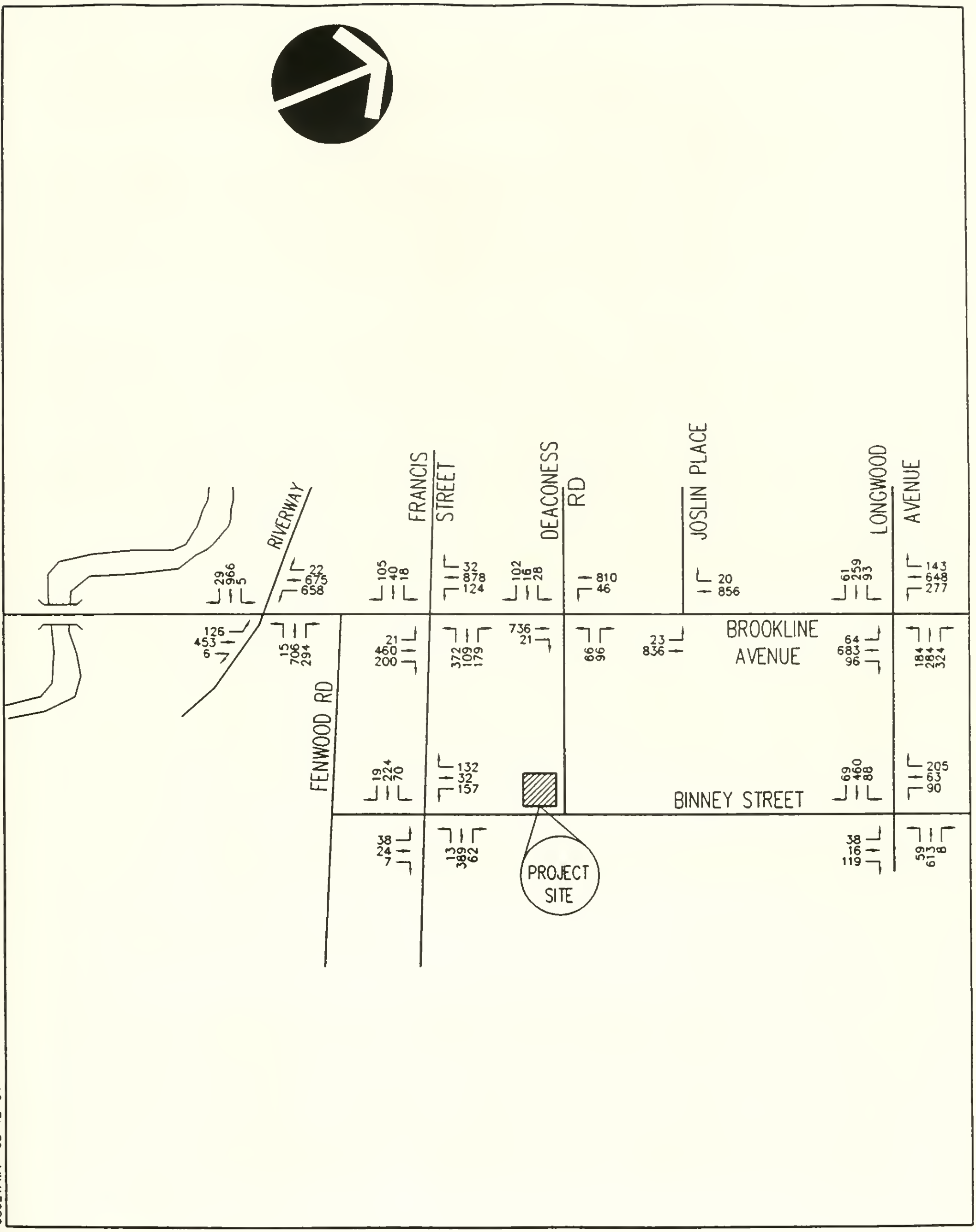

FIGURE IV.2-2
1998 NO BUILD PM PEAK HOUR TRAFFIC VOLUMES
DANA-FARBER CANCER INSTITUTE

HMM Associates, Inc.
A Summit Company

conservative when compared to trip generation based on number of employees. For a comparison of the two methods, please refer to the response Comment 1.13 in Chapter IX.

However, this does not take into account the modal share displayed on Table IV.1-2. When modal share is taken into account, the Project's net new vehicle trips are 180 trips during the AM peak hour, and 168 trips during the PM peak hour. These trips have been used as the conservative basis for estimating project impacts.

For comparison purposes only, trip generation numbers were also analyzed according to the 420 new employees projected for the project. As shown in Table IV.3-1, use of employee data decreases net trip generation by almost 50%. In fact, a review of other projects, including Harvard Institute of Medicine (EOEA #9428) utilized employee generated trip data. However, in order to remain consistent with the DPIR/DEIR as well as MEPA Guidelines, the more conservative 265,000 square footage method has been used for the trip generation analysis.

Table IV.3-1 ITE Trip Generation, Square Feet vs. New Employees

	AM Peak Hour			PM Peak Hour			Daily Trips
265,000 gsf	Enter	Exit	Total	Enter	Exit	Total	
Gross Trips	264	54	318	45	255	300	2,213
Net New Vehicle Trips	150	30	180	25	143	168	1,239
420 New Employees							
Gross Trips	159	33	192	29	163	192	1,387
Net New Vehicle Trips	89	18	107	16	91	107	777

3.2 Trip Distribution

In 1990, MASCO provided HMM with an employee zip code listing for 23,000 employees working within the LMA. HMM obtained a zip code map showing the geographic limits of each zip code boundary from the BRA. The home zip codes, which represent over 400 zip codes within Massachusetts, Rhode Island, New Hampshire, and Maine were assigned the employee percentages computed by MASCO. Eight trip origin/destination zones were then placed on a map, and the home base zip code data was shown at each

entering point. The directional distributions from these travel zone areas are as follows:

Travel Zones (Inbound)	Vehicle Trip Percentage
From Longwood Avenue (Brookline)	16%
From Brookline Avenue (Brookline)	32%
From Huntington Avenue (Brookline)	4%
From Longwood Avenue (Jamaica Plain/ Roxbury)	10%
From Brookline Avenue (Boston)	5%
From Huntington Avenue (Boston)	17%
From the Fenway (Boston)	16%
TOTAL	**100%**

In order to show the effects of the new trips resulting from the Project on the local street system, vehicle trips were distributed in the directions of the origin/destination zones and assigned to the actual roadways. These assigned volumes, when added to the existing and background traffic, formed the input for all LOS computations with the Project traffic.

3.3 1998 Build Traffic Volumes

Figures IV.3-1 and IV.3-2 show the traffic flow maps for the Project-generated vehicle trips for the AM and PM peak hours. This assignment is conservative in that not only does it utilize the higher square footage trip generation rates, but it also assumes that all new trips are destined to the site itself, rather than to other off-site parking locations.

Figures IV.3-3 and IV.3-4 show the 1998 Build traffic volumes (1998 background, other developments and site trips) for the AM and PM peak hours.

3.4 1998 Build Traffic Operations

A comparison of delay times and reserve capacities under the No-Build and Build conditions (Table IV.3-2) show that the Project traffic results in degradation of LOS at three of the six intersections, all during the AM peak. The Brookline Avenue at Longwood Avenue intersection will remain at LOS D, which is acceptable. The greatest significant impact will occur at the intersection of Brookline Avenue and Deaconess Road where LOS F conditions will occur during the AM peak hour due to the garage's proximity.

3.5 1998 Build Parking Conditions

Table IV.3-2 indicates that the Project will result in an increase in peak hour trips to the LMA. The construction of this Project will result in an increase in total parking supply of 188 spaces from the current inventory of 740 spaces (see Section IV.4). This does not, however, result in a net increase in employee spaces. A key aspect of the Project's construction will be to assign patients and visitors to all 138 spaces in the existing Dana Garage. This will leave 790 spaces to meet a demand for 970 employee spaces. Table IV.3-3 shows the 1998 parking demand and Table IV.3-4 the proposed 1998 parking assignments.

3.6 Transit

The Project is expected to increase public transportation use, including MASCO's Metrobus Service, by approximately 108 passenger trips during the AM peak hour and by 102 during the afternoon peak. This reflects a modest increase in ridership which should easily be absorbed by the MBTA and MASCO.

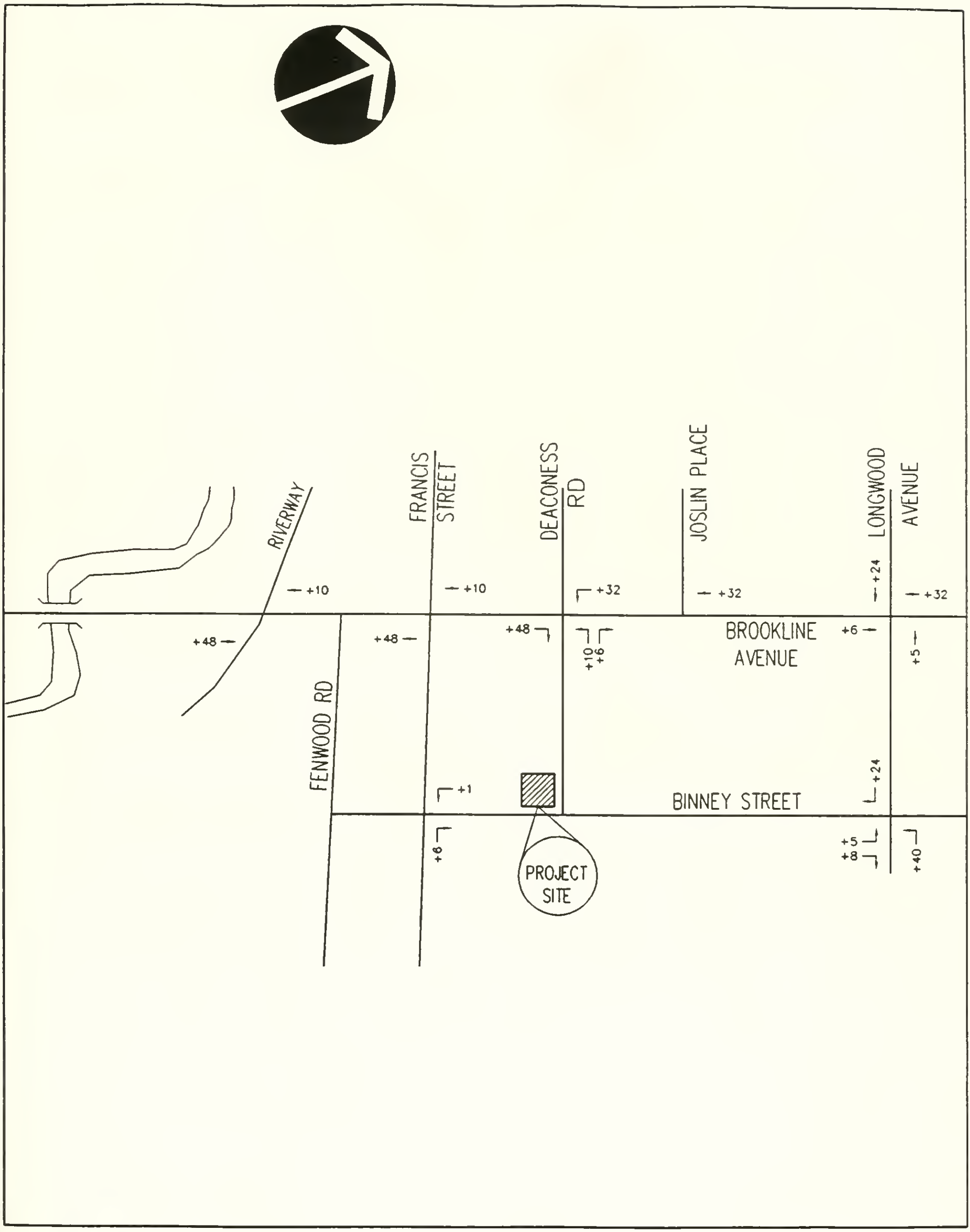

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FIGURE IV.3-1
AM SITE GENERATED TRIPS
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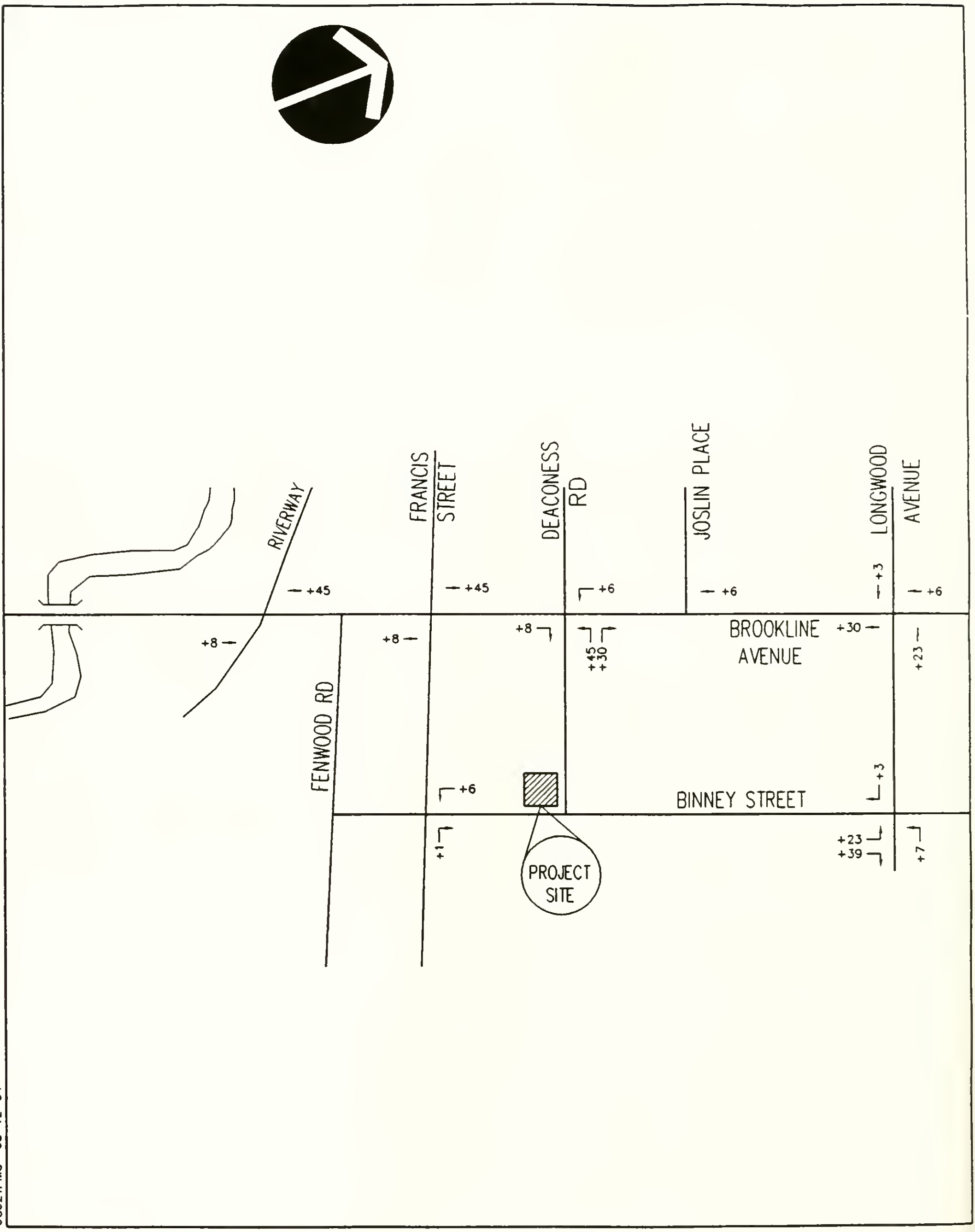

FIGURE IV.3-2
PM SITE GENERATED TRIPS
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Table IV.3-2 1993 Existing, 1998 No-Build and 1998 Build Peak Hour Level of Service

Signalized Intersections		1993 Existing				1998 No-Build				1998 Build			
		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
No.	Location	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
1.	Brookline Avenue/ Riverway	F	127.0	F	74.2	F	*	F	*	F	*	F	*
3.	Brookline Avenue/ Francis Street	E	48.8	C	20.1	F	*	E	51.0	F	*	E	52
4.	Brookline Avenue/ Deaconess Road	B	9.2	C	15.7	C	18.7	C	16.7	F	129	C	23
5.	Longwood Avenue/ Binney Street**	NA	NA	NA	NA	C	16.5	B	9.7	C	20	B	11
6.	Brookline Avenue/ Longwood Avenue	C	16.4	C	17.1	C	23.9	C	20.6	D	26	C	21

* Delay exceeds three minutes

** Longwood Avenue/Binney Street intersection is expected to be signalized by 1998 based on proposed mitigationf or Beth Israel Hospital's Clinical Center Project.

Unsignalized Intersections		1993 Existing				1998 No-Build				1998 Build			
		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
No.	Location	LOS	RC	LOS	RC	LOS	RC	LOS	RC	LOS	RC	LOS	RC
2.	Binney Street/ Francis Street												
	Left from Francis EB	A	803	A	697	A	730	A	652	A	723	A	651
	Left from Francis WB	A	938	A	997	A	904	A	964	A	904	A	964
	All from Binney NB	C	276	D	157	C	201	E	91	D	198	E	90
	All from Binney SB	D	163	E	9	E	66	F	-80	E	62	F	-90

**Table IV.3-3: Existing vs. Future Parking Supply and Demand
Dana-Farber Cancer Institute**

	Employees						Visitors/Patients							
Year	Full Time Day Employees[1]	Auto Mode Split	Auto Occupancy	Daily Autos (One Way)	Daily Turnover Rate (Utilization)	Employee Parking Demand (Long Term)	Visitors/ Outpatient[2]	Auto Mode Split	Auto Occupancy	Daily Autos (One Way)	Turnover Rate (Utilization)	Short Term Parking Demand	Total Parking Demand	Total Supply
1993	1,290	62%	1.09	734	1.0	734	180	95%	1.0	171	1.8	95	829	740
1998	1,705	62%	1.09	970	1.0	970	230	95%	1.0	219	1.8	121	1,091	928

1 There are 1,843 employees, 70% working the day shift.

2 Based upon 35,924 outpatients in 1992 averaged over 200 days. Increases by 5%/year.

Table IV.3-4 1998 Future Dana-Farber Cancer Institute Parking Assignments - Day Shift

Facility	Location	Ownership	Total Spaces	Physicians	Researchers	Nurses	Other Medical Staff	Others	Visitors/ Out-patients
1. Dana Building (4th & 5th Floor)	On-Campus	Dana-Farber	138	0	0	0	0	0	138
2. Smith Research Laboratories	On-Campus	Dana-Farber	246	106	105	2	7	26	0
3. Blackfan Street	Within LMA	Lease	75	25	24	2	11	13	0
4. 375 Longwood Avenue	Within LMA	MASCO	98	30	19	12	13	24	0
5. Servicenter	Within LMA	MASCO	45	11	3	16	6	9	0
6. Burlington Street	Nearby	Lease	25	0	25	0	0	0	0
7. Longwood Towers	Nearby	Leased	60	1	5	11	13	30	0
8. Kenmore	Nearby	MASCO	54	0	16	9	8	21	0
9. Lansdowne Street	Nearby	MASCO	80	0	42	4	11	23	0
10. Red Sox Lot	Nearby	MASCO	35	0	13	3	11	8	0
11. Wentworth	Nearby	MASCO	50	0	9	1	10	30	0
12. Beacon Street	Nearby	Leased	20	0	0	0	0	20	0
13. 1 Harvard Street	Outside	Leased	2	0	0	0	0	2	0
TOTAL			**928**	**173**	**261**	**60**	**90**	**206**	**138**

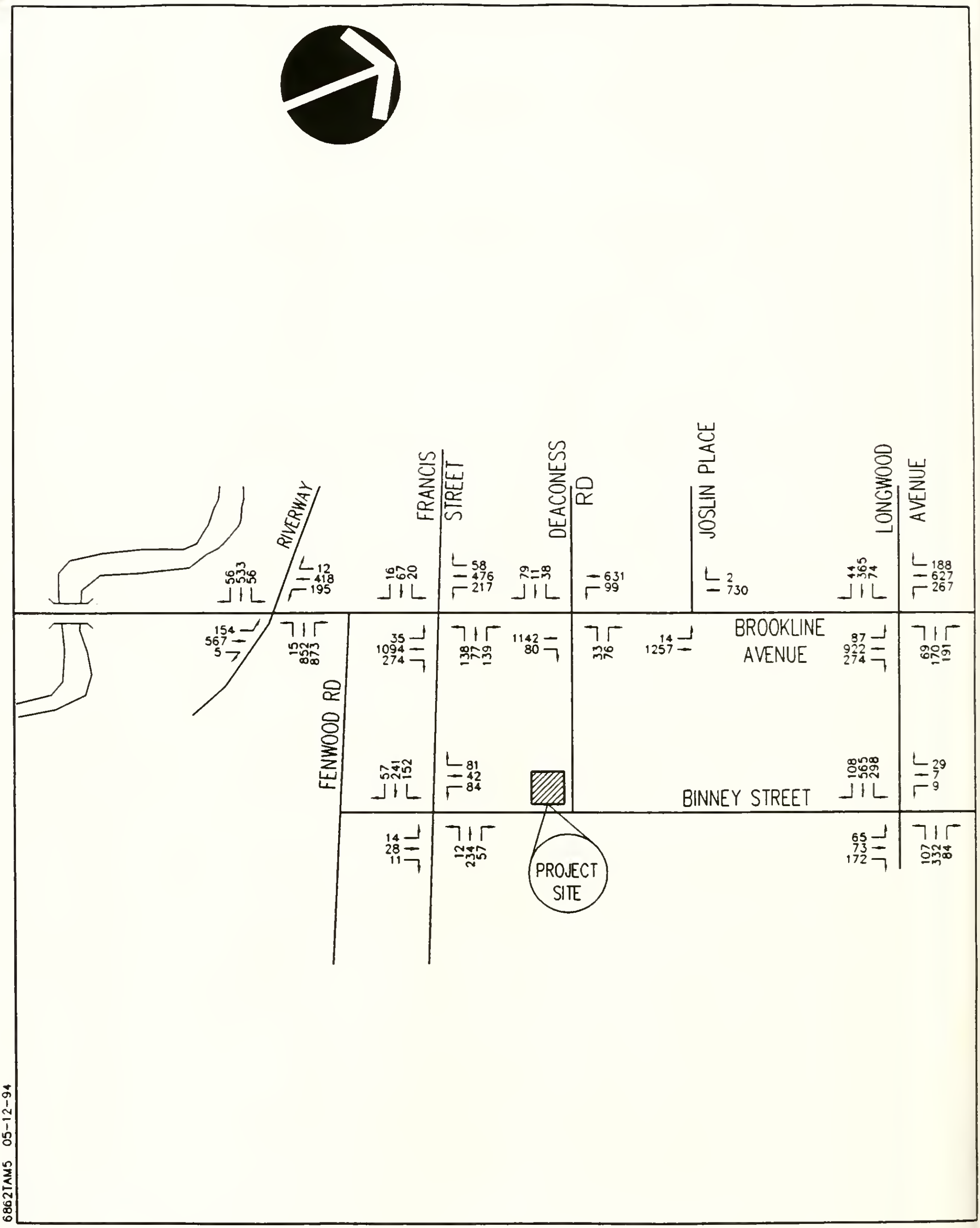

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FIGURE IV.3-3
1998 BUILD AM PEAK HOUR TRAFFIC VOLUMES
DANA-FARBER CANCER INSTITUTE

HMM Associates, Inc.
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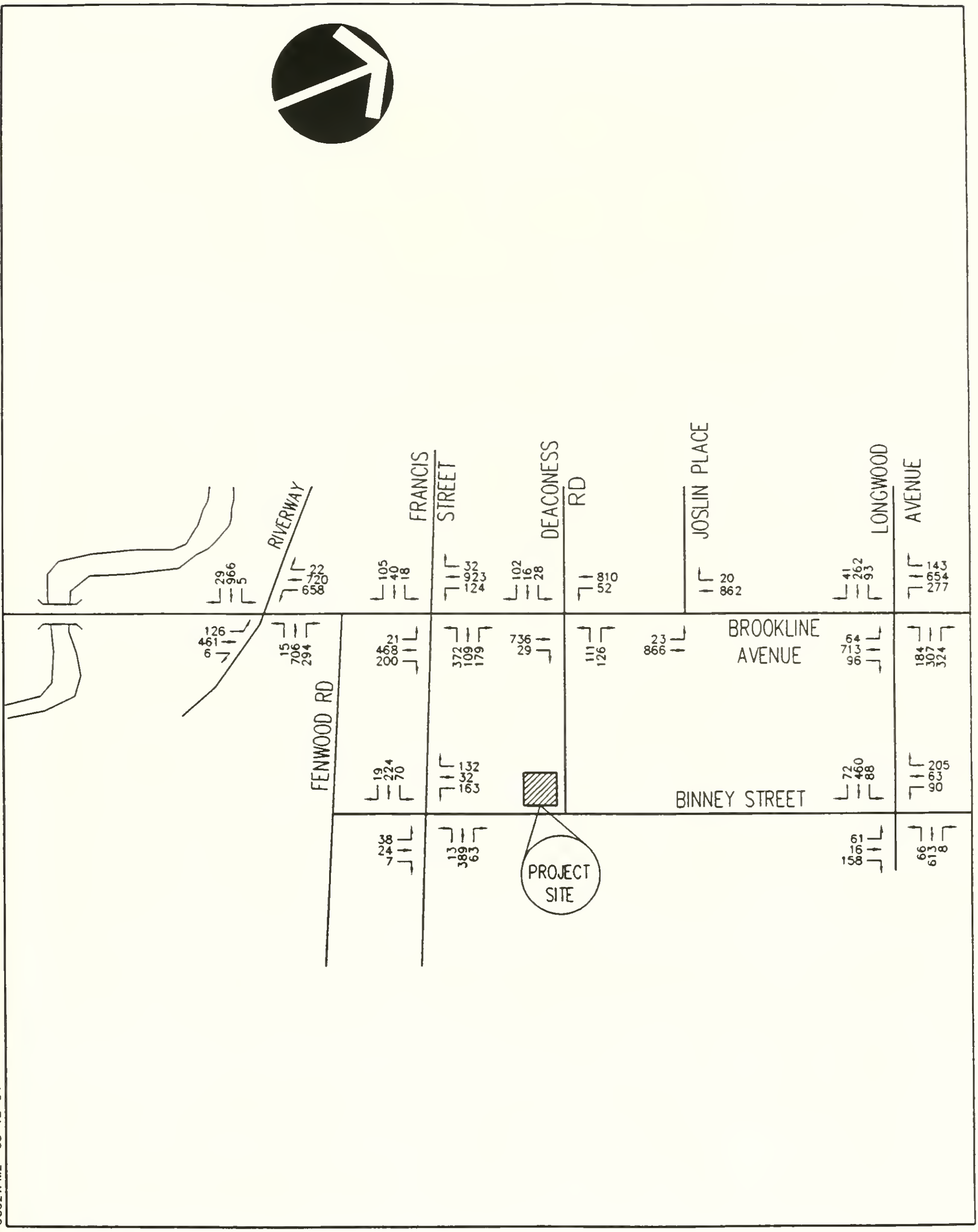

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FIGURE IV.3-4
1998 BUILD PM PEAK HOUR TRAFFIC VOLUMES
DANA-FARBER CANCER INSTITUTE

HMM Associates, Inc.
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4.0 TRANSPORTATION MITIGATION

The Institute's mitigation program is being formalized through a Transportation Access Plan (TAP) Agreement that is currently being negotiated between the Institute and the City of Boston Transportation Department (BTD). This Agreement will identify the required changes in modal share to be achieved by the Institute. The Agreement is a binding legal document with specific goals and objectives. This section contains the general outline of commitments which is expected to be contained in the Agreement.

4.1 Traffic Mitigation

4.1.1 Intersection Improvements

In order to mitigate impacts created by the Project, the proponent has reviewed potential improvements that can be implemented to improve traffic flow and operations. One option is to revise signal timing and phasing at the Brookline Avenue intersection with Deaconess Road. By adding a phase for Brookline Avenue southbound, as well as additional green time for the Deaconess Road phase, LOS B conditions can be achieved during both the AM and PM peak hours (see Appendix E for calculations).

While this change in signal timing will mitigate the Project's immediate impacts upon Deaconess Road, the need to develop an overall mitigation plan for Brookline Avenue between the Riverway and Longwood Avenue remains. Dana-Farber Cancer Institute and the BTD have reviewed alternative improvements to both Deaconess Road and surrounding intersections. Based upon these discussions, BTD recommended and the Institute agreed, that rather than implement the Deaconess Road improvement itself, the Institute will contribute $45,000 to BTD for construction of the following improvements: new loop detectors on Brookline Avenue between Longwood Avenue and the Riverway, new detectors on Francis Street and Deaconess Road, and a new actuated controller at Francis Street. In addition, MASCO has worked, and will continue to work, closely with LMA institutions and the City to implement roadway improvements at selected LMA locations (see Appendix D for listing of MASCO's priority transportation improvements).

4.1.2 Commuter Mobility Program

To accommodate the new person-trips generated by the Project, the Institute will continue its program of parking management, demand reduction and commuter mobility measures, which together will constitute a Commuter Mobility Program. Such Commuter Mobility Program will be administered in

cooperation with the efforts of the LMA Transportation Management Organization (CommuteWorks), a joint venture of the institutions in the Longwood Medical Area (LMA), operated under the auspices of MASCO.

The Institute endorses the aims of CommuteWorks to: accommodate all patients in and visitors to the LMA in reasonably priced off-street parking in close proximity to the patients/visitors' destinations; encourage the use of transit and ridesharing by all employees in the LMA; minimize Institute-generated traffic impacts in the Fenway/Kenmore/Mission Hill area through such means as allocation and pricing of employee parking; and improve traffic flow through the LMA by such measures as signage, striping, signalization, removal of on-street parking spaces, and other generally recognized engineering solutions.

The goals of the Commuter Mobility Program will be:

(i) Maximize the use of public transportation and ridesharing by persons working at the Institute.

(ii) Make available to all workers in the LMA improved access to mass transit and ridesharing services, through cooperative efforts with MASCO and other institutions in the LMA.

(iii) Foster, through cooperative efforts by MASCO with local and state government, improvements in transportation facilities, programs and services.

4.2 Parking

In order to promote the objectives stated above, the following measures will be taken by the Institute and included in the TAP Agreement.

4.2.1 Employee Parking Rates

Rates for employee parking will be structured so as to encourage employees to use economical commuting options available to them which make driving alone less attractive than ridesharing or taking public transportation. To further this policy, the Institute will adopt pricing schemes consistent with other institutions in the LMA and will charge amounts similar to those charged by other medical institutions for similar employee parking at other LMA facilities. The cost for remote parking will be less.

4.2.2 Patient/Visitor Parking Rates

Parking will be made available to visitors and patients on a priority basis in the Dana Garage.

4.2.3 Vanpool Parking Spaces

A reserved parking space in a preferred, convenient location will be provided for any vanpool which includes three or more employees of the Institute.

4.2.4 Parking Allocation

The Institute will assign off-site parking in a manner consistent with the goal of minimizing traffic within and through the LMA, Mission Hill, and Fenway/ Kenmore areas.

4.2.5 LMA Transportation Strategy Committee

The Institute will play an active role in the LMA Transportation Strategy Committee, with the aim of acting collectively in setting parking policies to achieve area-wide transportation goals, through such measures as joint use of off-site parking facilities.

4.2.6 Satellite Parking

Through MASCO, the Institute will work with other LMA institutions, BTD, and regional agencies to develop satellite parking facilities and shuttle services for the use of persons employed in the LMA.

4.3 Ridesharing

The Institute will continue to promote ridesharing in the form of carpools and vanpools for Dana-Farber employees, both on the Project site and elsewhere in the LMA. To that end, the Institute shall incorporate with MASCO:

(a) Participation in carpool/vanpool matching programs in coordination with the LMA Transportation Management Organization (TMO), utilizing surveys of the Institute's employees and computer-based matching techniques.

(b) Participation in joint ridesharing programs with other institutions within the LMA.

(c) Participation in a monthly newsletter promotional materials to inform employees and aid them in ridesharing.

(d) Participation in cooperation with CommuteWorks and other LMA institutions, "Transportation Days" during which transit alternatives will be promoted and opportunities afforded to enlist employees in ridesharing programs, including those at all off-campus facilities.

(e) Provide promotional materials to the Institute's employees, and promote carpooling and vanpooling by the installation of transportation information literature racks in common areas at both on-campus and off-campus locations, articles in the Institute's newsletters, and other appropriate means.

(f) Continue to convey information about transit and ridesharing alternatives to new employees through the employee orientation process.

(g) Support the development of CommuteWorks' carpool/vanpool matching and Metrobus transit services.

(h) Encourage use of carpools.

(i) Work with MASCO to investigate the feasibility of discounting parking rates at remote facilities for carpools.

(j) Support development of, and participation in, a "guaranteed ride home" program for carpoolers and vanpoolers.

4.4 Transit

(a) The Institute will provide an on-site location for transit pass sales.

(b) The Institute will continue its program of subsidizing the cost of MBTA transit passes, which subsidy is currently 25% for employees and staff.

(c) The Institute will continue to require that employees who purchase subsidized MBTA passes surrender their commuter parking permits.

(d) The Institute will coordinate with CommuteWorks, the MBTA, BTD, and other agencies and employers to encourage the MBTA to institute programs facilitating the bulk purchase of tokens or tickets through means other than monthly passes. If a financially feasible program is instituted, and can be managed with reasonable efforts by the Institute, the Institute will participate.

4.5 Pedestrians and Bicyclists

(a) Pedestrian maps and signage will be installed which provide clear information regarding location of facilities and pedestrian routes.

(b) The Institute will provide secure, protected, convenient, and free bicycle parking.

(c) The Institute will provide access to locker space and shower facilities to all employees and staff of the Institute who commute to work by bicycle.

4.6 Traffic Maintenance

The Institute will prepare a Traffic Maintenance Plan which details measures to insure the maintenance of existing levels of service on adjacent roadways during the construction of the Project and to minimize disruption at neighboring residential sites. To that end, initial meetings have been held with BTD. Such approval shall be obtained prior to the Institute obtaining any building permit for the Project from the City of Boston Inspectional Services Department (ISD). It is understood by the Institute that the development of a Traffic Maintenance Plan is a pre-condition to the issuance of a building permit for the Project by ISD.

The Traffic Maintenance Plan will include, but not be limited to, measures dealing with: proposed street occupancies; use of tower cranes; sidewalk occupancies or obstruction of pedestrian flow; materials staging; transportation and parking for construction workers; hours of construction work; and materials delivery.

4.7 Transportation Coordinator

The Institute will designate a transportation coordinator who shall cooperate with the BTD in the execution and monitoring of the obligations set forth in the TAP Agreement.

4.8 Regional Transit Improvements

MASCO has been participating in the ongoing analysis of the feasibility of constructing a circumferential transit system linking the existing major transit lines outside downtown Boston. As presently envisioned, it would provide direct service between Boston, Brookline, Cambridge, Somerville, and Chelsea. The effect of this ring of transit service would be to support existing employment centers and to help create new ones, and to provide attractive

transit options for residents of the inner neighborhoods and communities, as well as the suburbs, for their daily commute to work.

The circumferential transit system would be a major benefit to the LMA, to its employees, patients and neighbors. In recognition of this importance, MASCO has founded the Circumferential Transit Employers Coalition (CTEC) to support planning efforts for this system. While the full system is many years away, MASCO's current circumferential planning efforts in the LMA are focused on improvements to transit services and other shuttle and high occupancy vehicle (HOV) services that can be accomplished in the short term. In the interim, these improvements would help achieve some of the benefits anticipated by better transit service to this important employment area in Boston.

MASCO is also encouraging the timely funding of the studies needed to evaluate the feasibility of the circumferential service as part of the Commonwealth's "Transportation Plan for the Boston Region" and the "Program for Mass Transit" so that this Project can be in line to secure funding in the Federal authorizations expected in 1996. These studies would be used to establish the costs and benefits status of the service, evaluate preferred alignments and types of vehicles, and identify a phased implementation approach.

4.9 Summary and Conclusions

Dana-Farber will continue to implement its transportation demand management program designed to reduce single occupancy vehicle use by its employees. The plan includes increased transit subsidies, the successful CommuteWorks program, and parking validation for patients. By 1998, the Institute anticipates significant improvements in modal share and vehicle occupancy, thus limiting demand for parking.

With the above measures in place, and enforced through a TAP Agreement, the Institute expects to experience a significant increase in transit ridership and vehicle occupancy rates. It is Dana-Farber Cancer Institute's stated policy that on-campus parking be restricted to patients, visitors, physicians, second-shift nurses and key personnel. All other employees are encouraged to park outside of the LMA. The Institute will continue to use space outside of the LMA to serve parking demand in 1998. At the present time the parking spaces identified are the same locations as currently leased or owned by the Institute. However, it is quite possible that by 1998 MASCO will have identified and developed one or more centralized satellite locations for use by all LMA institutions.

In addition, the contribution of $45,000 toward signal improvements along Brookline Avenue will serve to mitigate potential impacts resulting from construction of the Project.

V. ENVIRONMENTAL PROTECTION COMPONENT

DANA-FARBER
CANCER INSTITUTE

V. ENVIRONMENTAL PROTECTION COMPONENT

The BRA's Preliminary Adequacy Determination (PAD) on the DPIR identified additional technical information to be included in the FPIR relating to pedestrian-level qualitative wind assessment, shadows, daylight, air quality, geotechnical impacts and infrastructure. This information is presented in this chapter. (The Secretary's Certificate on the DEIR identified issues relating primarily to traffic and transportation which were discussed in Chapter IV.)

1.0 PEDESTRIAN-LEVEL QUALITATIVE WIND ASSESSMENT

As requested in the PAD, the pedestrian-level qualitative wind impact assessment has been revised in light of the revised project design. Existing and Build condition graphic figures have been placed on facing pages to improve readability. The building heights identified in the text and given in Figure V.1-1 have also been reviewed and revised, as appropriate.

The wind assessment and revisions were completed by Frank H. Durgin, P.E. the results of which are summarized in this section. The DPIR/DEIR section pertaining to technical wind climate information in Boston has not been reprinted, as reference to the DPIR/DEIR should be sufficient.

1.1 Description of the Project Area

1.1.1 Surrounding Area

The area surrounding the Project site contains buildings with roof elevations between 45 and 305 feet above Boston City Base (BCB) and thus currently provides much sheltering for the site for winds from most directions. These elevations are shown in Figure V.1-1. To the northeast is the Dana Building at El. 214 feet; to the north is the Children's Hospital Residence Tower at El. 305 feet and Dana-Farber's Mayer Building at 440 Brookline Avenue with a roof at El. 135 feet. To the north-northwest across Brookline Avenue is the expanded Joslin Diabetes Center at El. 139 feet. To the northwest and west, between the site and Brookline Avenue, are 454 Brookline Avenue and Dana-Farber's Redstone Building, at El. 50 and 65 feet, respectively. Across Brookline Avenue is the new Deaconess Clinical Facility, currently under construction, at El. 163 feet, and beyond that, other taller buildings up to about El. 200 feet. To the immediate southwest is the MATEP facility with its cooling towers at El. 180 feet. Finally, to the southeast lies the Brigham and Women's Hospital Inpatient Bed Tower at El. 238 feet; to the east is Dana-Farber's Jimmy Fund Building at El. 144 feet, and to the northeast, the Children's Hospital at El. 155 feet.

Entrances, and the walkways and sidewalks leading to them, are the most important pedestrian areas to be considered for a Project. This is particularly the case in the LMA where there is much pedestrian activity and interaction between the various buildings. However, there are only a few existing entrances that need to be considered. The Deaconess Road entrance to the 454 Brookline Avenue Building, the main entrance to the existing Dana Building which is under a canopy off Binney Street, and the entrance to the Jimmy Fund Building on the southwest side of Deaconess Road. There is also an entrance to the Jimmy Fund Auditorium off Binney Street that is set back and below-grade off the west corner of the building. This entrance is sheltered from all winds and will remain so when the Project is in place.

There are two major walkways that connect Brookline Avenue to Binney Street. One is along the northeast wall of the MATEP facility. The other walkway runs between the Mayer Building at 440 Brookline Avenue and the Children's Hospital Residence Tower. An entrance to the Longwood Galleria is near the Binney Street end of this walkway. The winds there are mostly determined by the Children's Hospital Residence Tower.

1.1.2 Site Area

The Project site is mostly open and used for parking, but there is also a small three story brick building and a small garage. For the Project, the existing building will be removed and replaced by a 13-story, 184-foot* tall building. The Smith Research Laboratories will have a roof-top cooling tower which will be approximately 30 feet high. Figure V.1-1 also shows the Project building elevations including the research laboratories.

There will be a one story bridge over Deaconess Road at the third floor level connecting the west corner of the research laboratories with the existing Dana Building. The street level entrance to the main lobby of the new building will be on Deaconess Road about 45 feet southeast of the bridge. One of the three other entrances will be just southeast of the bridge. Another will be at the east corner of the building facing Binney Street. The last will be at the building's west corner (accessed from Deaconess Road). Also, a bridge is planned across Binney Street at the third level between the Jimmy Fund Building and the Smith Research Laboratories to replace the existing second story bridge connecting to the Dana Building. The Binney Street corner entrance will be under this bridge.

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* Based on a ground elevation of 43 feet BCB and includes the height of the building to the roof line, excluding the parapet.

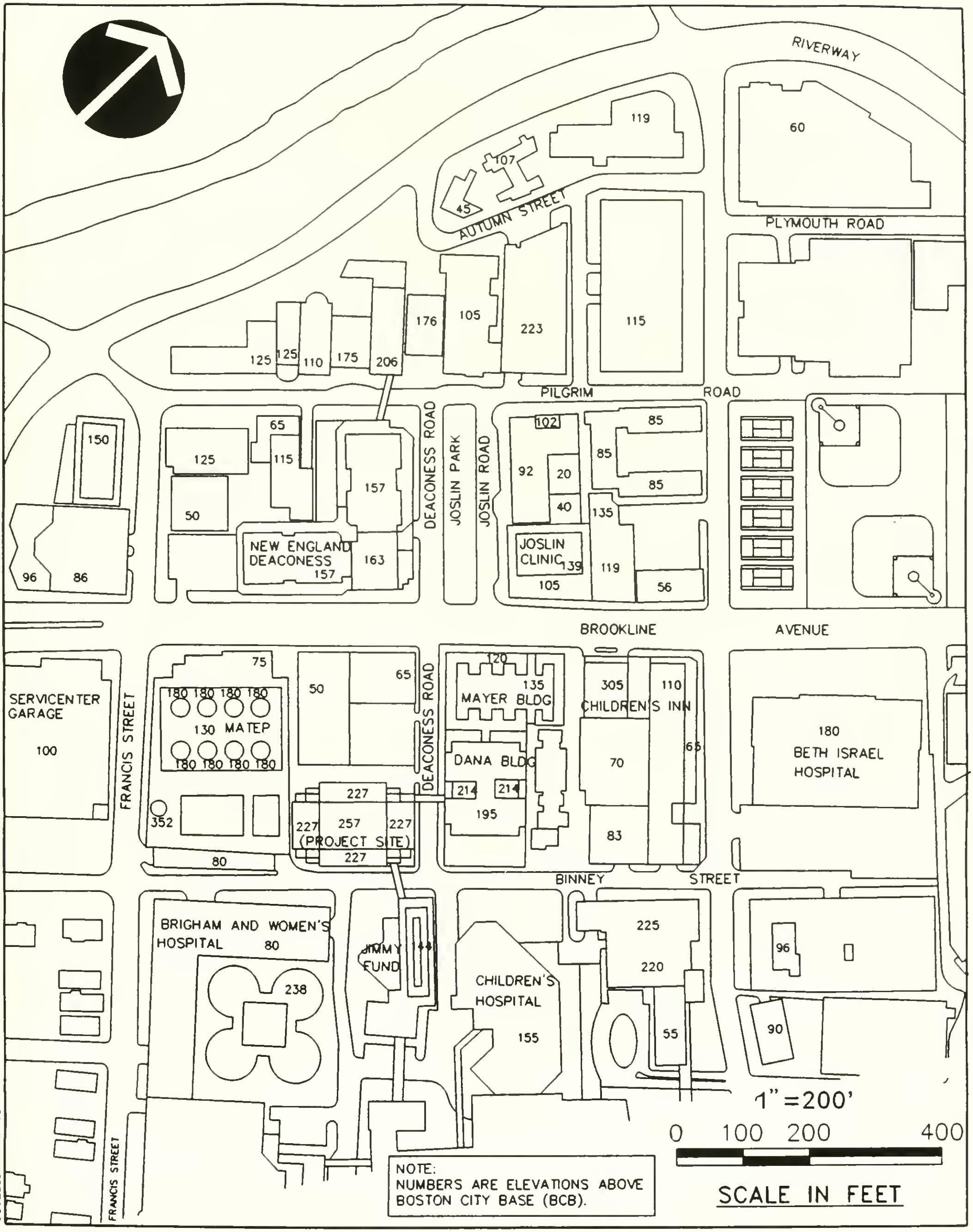

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FIGURE V.1-1
BUILDING ELEVATIONS
SMITH RESEARCH LABORATORIES

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There is an existing pedestrian walkway that runs along the northeast facade of the MATEP facility from Brookline Avenue to Binney Street. That walkway will remain after construction of the Project.

1.2 Pedestrian Level Wind Criteria

Since the early 1980s, Boston has used a guideline criteria for acceptable winds of not exceeding 31 mph effective gust more often than once in 100 hours. The effective gust is defined as the average wind speed plus 1.5 times the root mean square (rms) variation about the average and can be thought of as a one minute gust. Based on wind data collected for Boston, this 31 mph effective gust is comparable to an average wind speed of 22.5 mph.

In 1978, Melbourne* developed a probabilistic criteria for average pedestrian level wind speeds (PLWs) which accounted for different types of pedestrian activity as well as the safety aspects of such winds (see Figure V.1-2). He defined five categories of PLWs:

1) Dangerous and Unacceptable;
2) Uncomfortable for Walking;
3) Comfortable for Walking;
4) Comfortable for Short Periods of Standing and Sitting; and
5) Comfortable for Long Periods of Standing or Sitting.

These criteria are not absolute (any location can have dangerous winds in a hurricane); rather, they imply that the location would have wind speeds such that the activity suggested is possible most of the time, and would be perceived as such, by most people who frequent the location. For example, the winds at pedestrian level at Logan Airport are in Category 2 (see Figure V.1-2), uncomfortable for walking, and are just under the Boston 31 mph effective gust wind speed guideline (converted to an average wind). Therefore, most people would perceive conditions in the open at Logan Airport as uncomfortable for walking.

The following discussion provides Melbourne categories for specific wind directions. Overall, categories for all wind directions would be less than the greatest of these.

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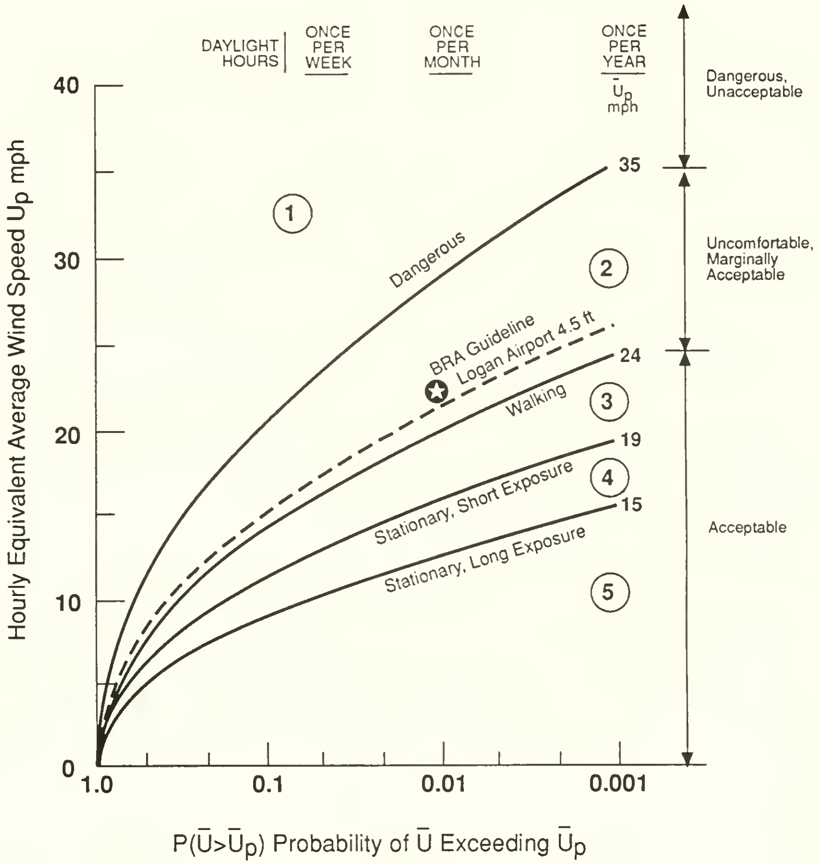
* Melbourne, W.H., "Criteria for Environmental Wind Conditions," Journal of Industrial Aerodynamics, Vol. 3, 1978, pp. 241-249.



◯ Melbourne's Category

1 Unacceptable and dangerous
2 Uncomfortable for walking
3 Acceptable for walking
4 Acceptable for short periods of standing or sitting
5 Acceptable for long periods of standing or sitting

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FIGURE V.1-2
MELBOURNE'S CRITERIA FOR HOURLY MEAN WIND SPEEDS
SMITH RESEARCH LABORATORIES

1.3 Pedestrian Level Winds at the Site

In the following sections, the effects of northwest winter winds, southwest summer winds, and easterly storm winds are discussed for the existing and Build (with the revised Project) conditions. The discussion includes considerations of PLWs on the sidewalks and at pedestrian entrances to all nearby buildings along Deaconess Road, Binney Street and Shattuck Street. Melbourne's PLW categories are depicted on figures for each wind direction evaluated. Any effect on Brookline Avenue near its intersection with Deaconess Road is also considered.

1.3.1 Northwest (Winter) Winds (Figures V.1-3 and V.1-4)

Northwest winds blow almost directly up Deaconess Road from Brookline Avenue towards Binney Street. Thus, the Deaconess Buildings (in particular the new Clinical Facility now nearing completion and the Farr Building off Pilgrim Road) on the other side of Brookline Avenue are upwind of the site for northwest winds.

1.3.1.1 Northeast Winds for Existing Conditions

For existing conditions and northwest winds, the site and the areas that will be influenced by the proposed building are not very windy, as indicated in Figure V.1-3. The northwest wind is slowed and turbulence is added as it passes over the Deaconess Farr Building and new Clinical Facility. The turbulence causes the slowed northwest wind to drop to ground level so that it blows up Deaconess Road. Thus, the entrance to 454 Brookline Avenue off Deaconess Road is somewhat windy (Melbourne Category 3).

The main entrance to the existing Dana Building is under a canopy and faces Binney Street and therefore is not windy during northwest winds (Category 5). However, the north corner of the Jimmy Fund Building under the existing bridge at the corner of Binney Street and Deaconess Road is probably windy (high Category 3). However, the entrance off Deaconess Road is not particularly windy (low Category 3 or high 4).

The northwest winter winds also blow directly at the northwest face of the Brigham and Women's Bed Tower and straight down Shattuck and Francis Streets. Except for its stack, the MATEP facility, which is just upwind of the Bed Tower for northwest winds, is about the same height as the low rise building surrounding the BWH Bed Tower. The northwest wind hits the tower and comes down the northwest facade through the gap between the

tower and the low rise section and into the parking area under the low rise. Once in the garage area, some of the wind passes around the north and west corners of the tower making those areas windy, probably in Melbourne Category 3. The rest of that wind goes through the parking area and out toward Binney Street. It is not very strong in the parking area, but becomes stronger as it passes through the narrower openings to Binney Street. Thus as one walks along the sidewalk on Binney Street nearest the tower, one experiences streams of wind coming out of the openings to the parking area (Melbourne 3). Once out on Binney Street these streams of wind combine with a wind caused by the existing Dana Building to create a stronger wind blowing down Binney Street toward Francis Street along the sidewalk next to MATEP (Melbourne 3).

The pedestrian walkway along the northeast facade of the MATEP building is now in the lee of the Deaconess Clinical Facility for northwest winds and not windy (Category 4 at most).

1.3.1.2 Northwest Winds for Build Conditions

With the Smith Research Laboratories in place, winds at the entrance to 454 Brookline Avenue on Deaconess Road will be unchanged. Because of its height, the Project will block the northwest winds from most of Binney Street near it. There will be some windiness near the north corner of the Smith Research Laboratories, especially under the proposed bridge to the existing Dana Building. However, because the first floor facade will be set back behind the colonnade, the winds there will probably be no worse than Category 3. Winds at the main entrance to the Smith Research Laboratories, which is approximately 45 feet further to the southeast along Deaconess Road, will be no worse than Category 4. Winds near the entrance at the west corner from the pedestrian walkway will be stronger (high Category 3), however, remaining comfortable for walking, its intended use. However, because of its setback, the entrance itself there will be sheltered (Category 4 or 5). Also, winds in the pedestrian walkway between the Project and MATEP will be high Category 3, comfortable for walking. Winds in the walkway nearer to Brookline Avenue will be unaffected or reduced.

The east entrance to the building at Binney Street will not be windy. The Smith Research Laboratories may reduce the winds at the north corner of the Jimmy Fund Building to low Category 3 or high Category 4. This will occur because the Smith Research Laboratories will be taller than the Jimmy Fund Building and will act to partially block the wind from it. Winds at the Jimmy Fund entrance off Deaconess Road may be increased to Category 3, but will remain suitable for walking.

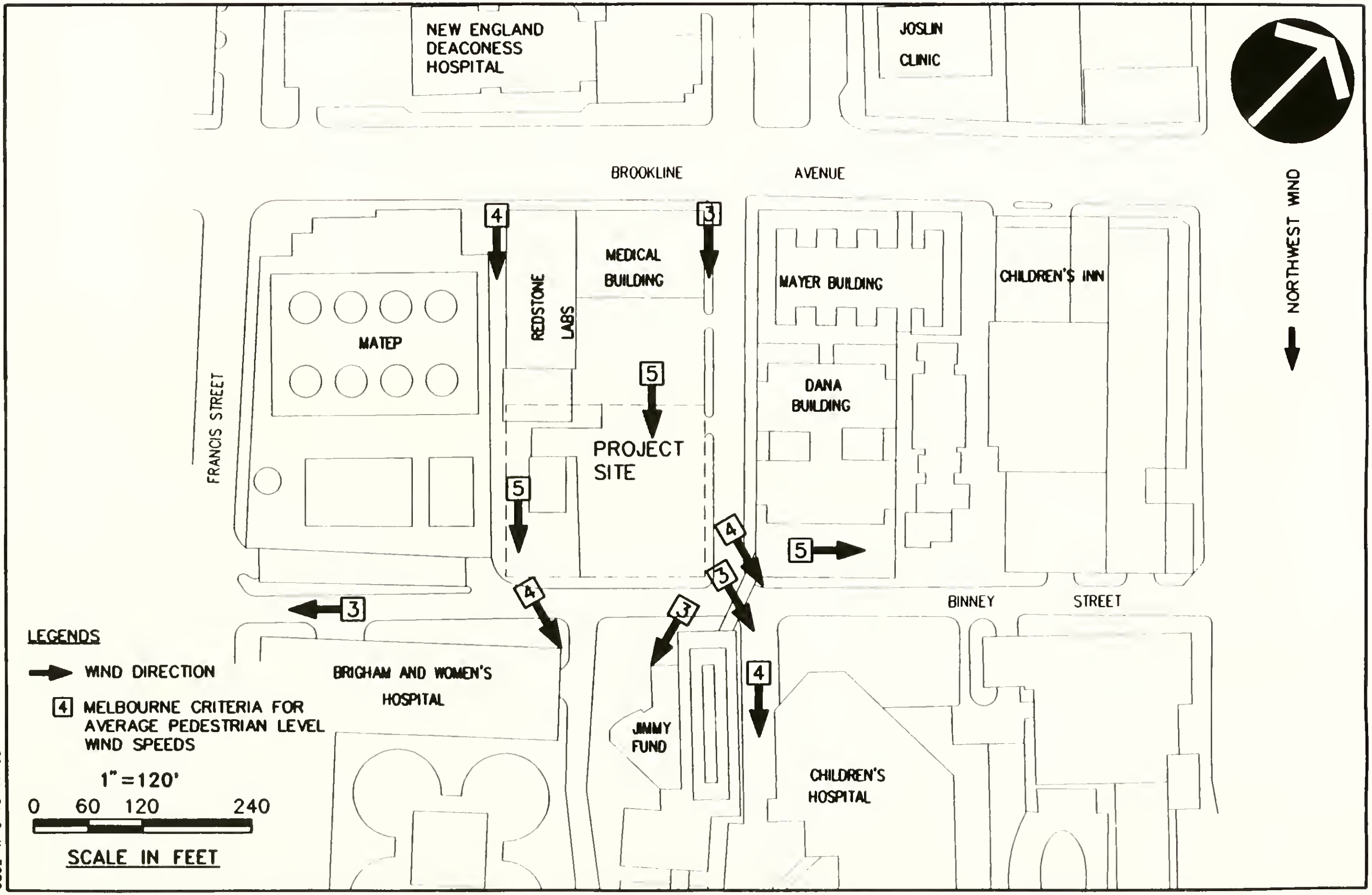

FIGURE V.1-3
EXISTING NORTHWEST WINDS
SMITH RESEARCH LABORATORIES

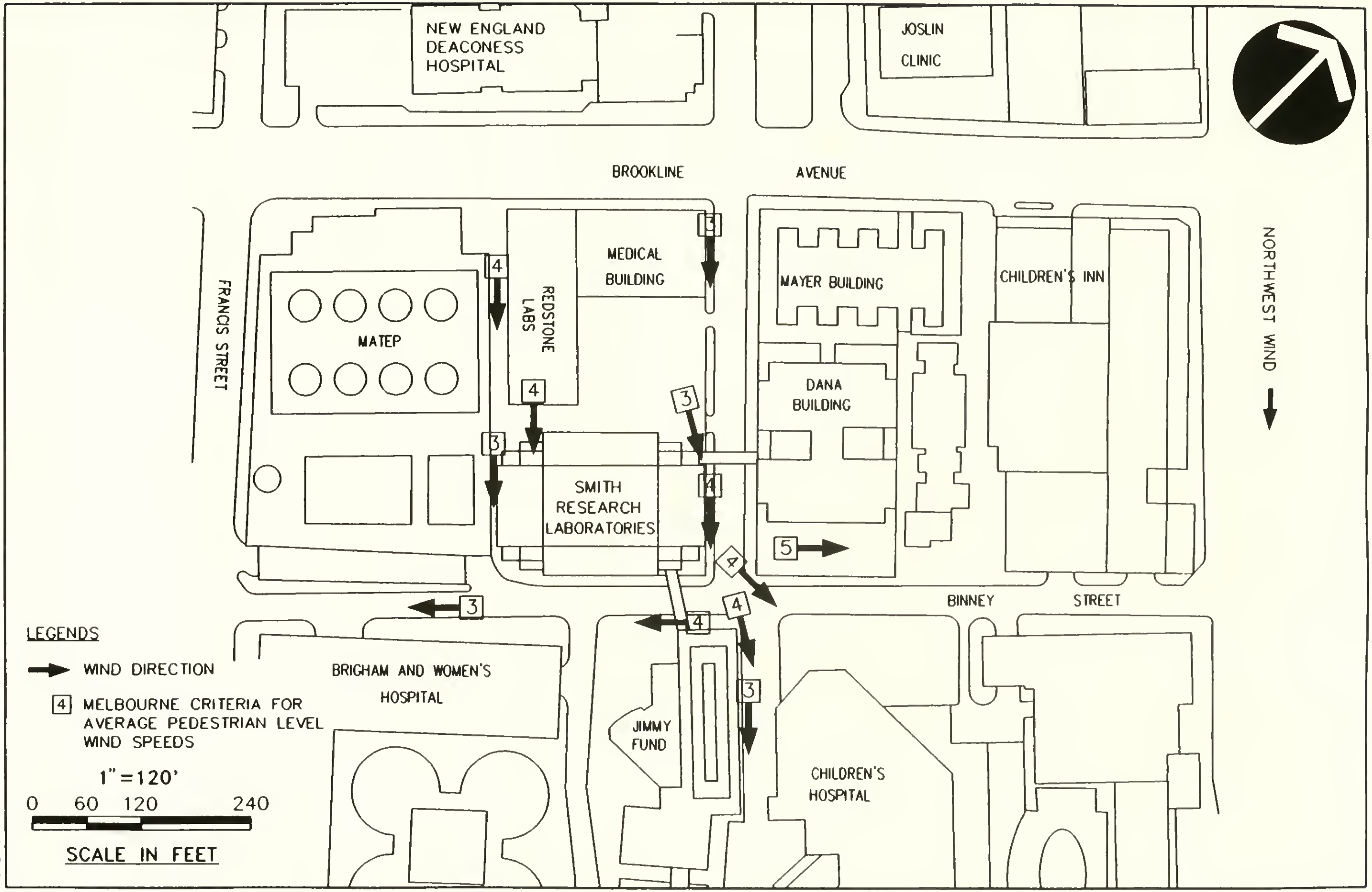

FIGURE V.1-4
BUILD NORTHWEST WINDS
SMITH RESEARCH LABORATORIES

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Finally, because of its height, the Smith Research Laboratories will block some of the flow that now turns down Binney Street toward Francis Street. Thus, winds along Binney Street in the Project area will be reduced.

1.3.2 Southwest (Summer) Winds (Figures V.1-5 and V.1-6)

The prevailing winds in the summer are from the southwest. Southwest winds approach the site coming directly up Binney Street from Francis Street toward Longwood Avenue. It should be born in mind that, on hot summer days, some windiness may be desirable.

1.3.2.1 Southwest Winds for Existing Conditions

During southwest winds, much of the site is totally in the lee of the MATEP facility and not windy (Category 4 or 5). However, because the existing Dana Building is taller than the MATEP facility, a vortex forms in front of the Dana Building, causing some windiness on Deaconess Road and at the existing site parking lot (Category 3-4). Nearer Brookline Avenue, the entrance to the 454 Brookline Avenue building on Deaconess Road is very sheltered from southwest winds (Category 5).

The main entrance to the existing Dana Building would be quite windy if it were not set back and under a canopy. As such, winds are probably in Category 5.

The sidewalk under the existing bridge between the Dana Building and the Jimmy Fund Building is probably somewhat windy (low Category 3). However, the Jimmy Fund Building entrance off Deaconess Road will not be windy (Category 5).

The pedestrian walkway next to the MATEP facility that runs from Brookline Avenue to Binney Street is completely sheltered for southwest winds (Category 5).

While southeast winds blow up Binney Street from Francis toward Deaconess Road, the winds along Binney Street are modest (Category 4).

1.3.2.2 Southwest Winds for Build Conditions

For the most part, the Smith Research Laboratories will have little or no effect on southwest winds at or near the site. The exception will be near the corner of Binney Street and Deaconess Road. Winds under the bridge connecting the

Project to the Jimmy Fund Building may be increased somewhat (to Category 3). However, removal of the diagonal bridge will reduce winds at the intersection of Binney Street and Deaconess Road. The Category 5 winds at the entrance to the Jimmy Fund Building will be unchanged.

The four entrances to the Smith Research Laboratories will be in the lee of the building itself or the MATEP facility and the winds at and near them will probably be in Category 5.

1.3.3 Easterly Storm Winds (Figures V.1-7 through V.1-12)

Easterly winds occur about one third of the time. Light easterly winds occur as a storm starts or in the summer as a sea breeze. During the first four to twelve hours of a typical storm, it rains or snows depending on the temperature, and the wind is from the northeast or southeast depending on whether the center of the storm passes to the east or west of the city. For strong easterly winds, it will generally be raining or snowing, and people expect it to be windy.

Because easterly winds cover such a wide range of wind directions, the discussion will cover northeast, east, and southeast winds separately.

1.3.3.1 Easterly Winds for Existing Conditions

Northeast winds blow along Binney Street from Longwood Avenue toward the MATEP facility and Francis Street. For northeast winds, the site is in the lee of the existing Dana Building. Thus, the site and most of the area around it are not windy. The Jimmy Fund entrance off Deaconess Road on the building's northeast wall is probably in Category 4. The main entrance to the Dana Building which is set back under its canopy is not windy.

For east winds, the site is in the lee of Children's Hospital and the Jimmy Fund Building and therefore not windy. The only exceptions are the walkway next to MATEP where winds may be in Category 4, and at the Jimmy Fund entrance on Deaconess Road (Category 4).

For southeast winds, the site is in the lee of the Jimmy Fund Building, the Brigham and Women's Bed Tower, and the new Brigham and Women's Center for Women and Newborns on Shattuck Street. All of the site and its immediate surroundings are effectively sheltered from southeast winds by these buildings.

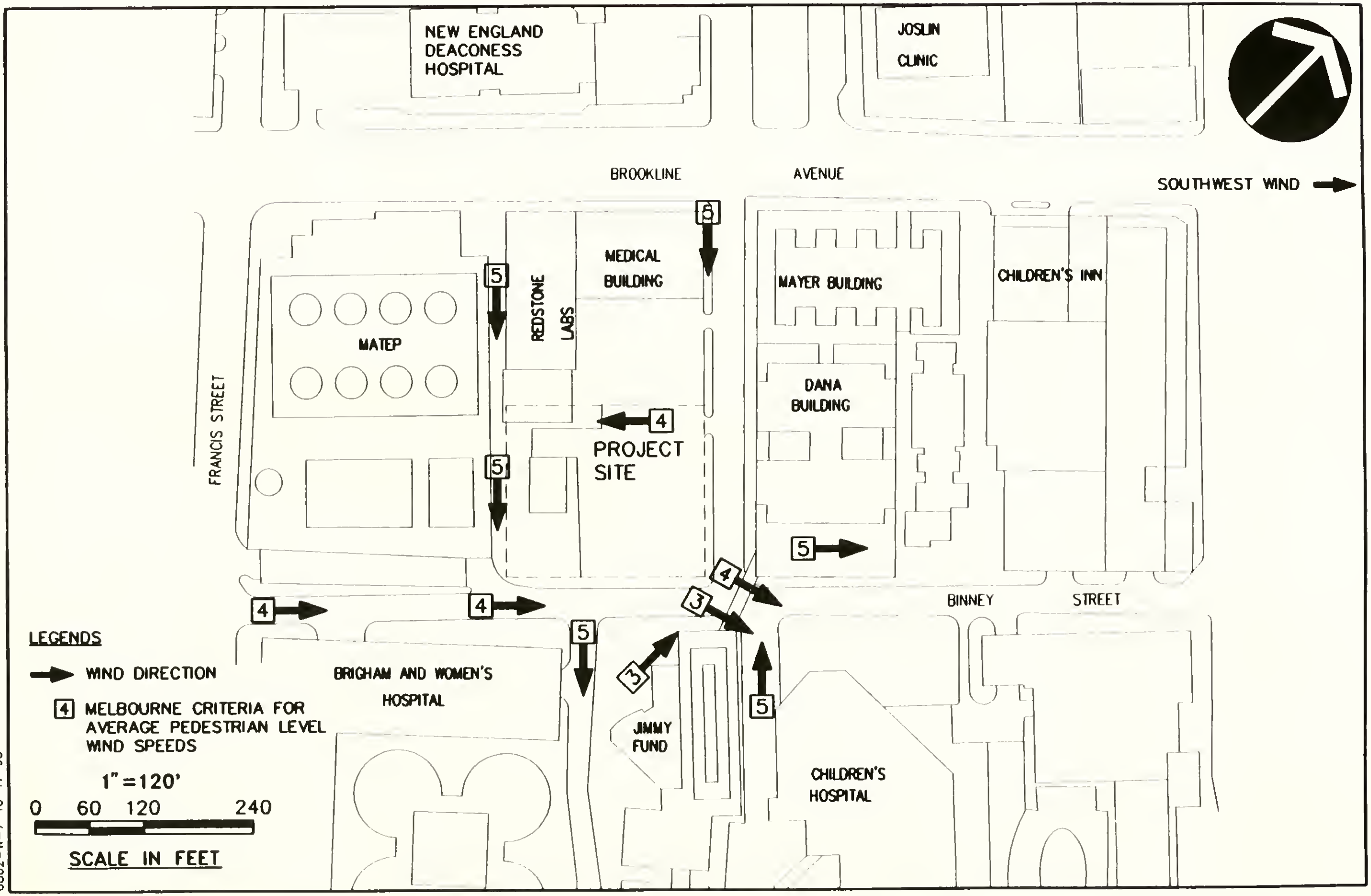

FIGURE V.1-5
EXISTING SOUTHWEST WINDS
SMITH RESEARCH LABORATORIES

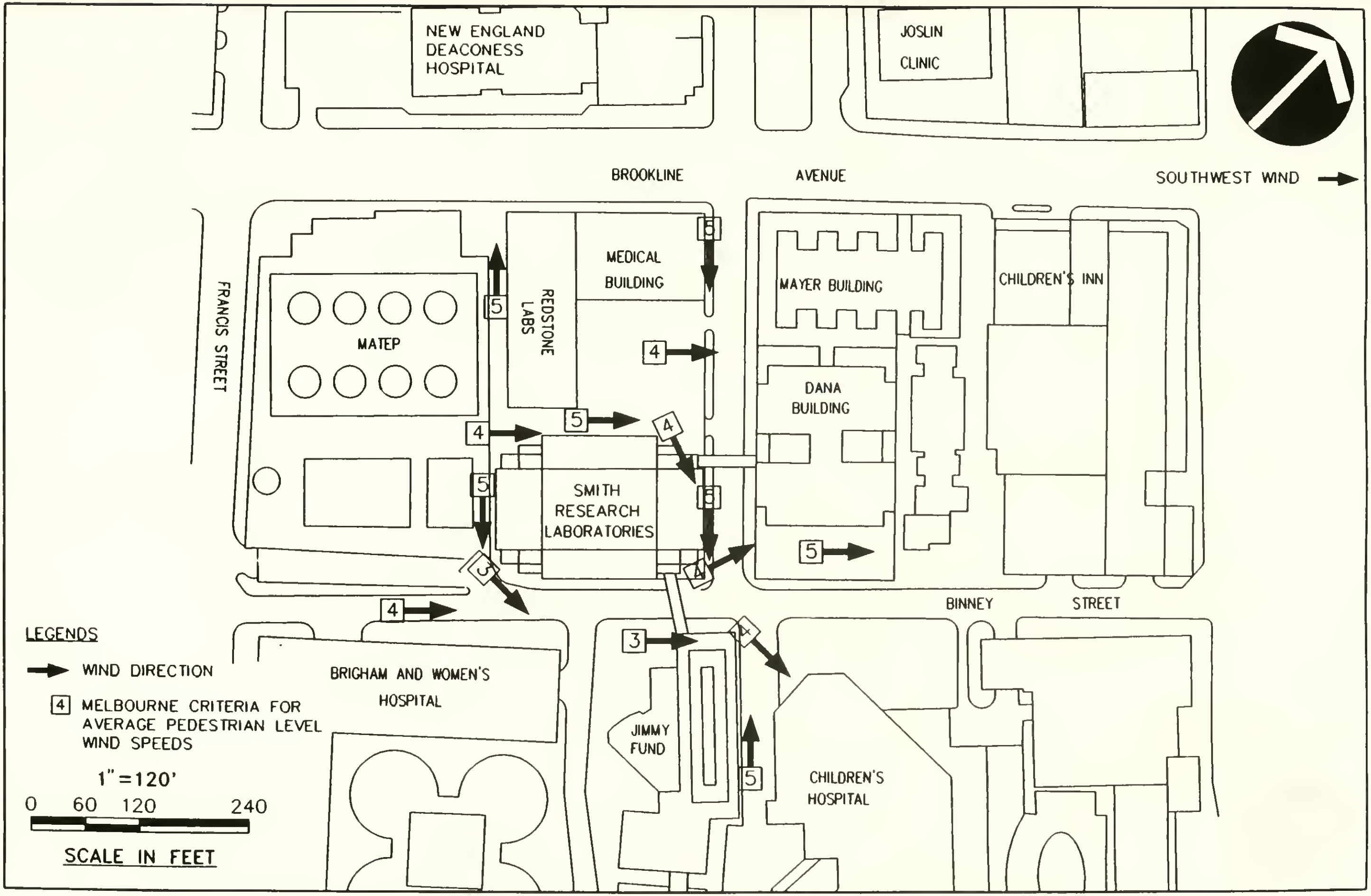

FIGURE V.1-6
BUILD SOUTHWEST WINDS
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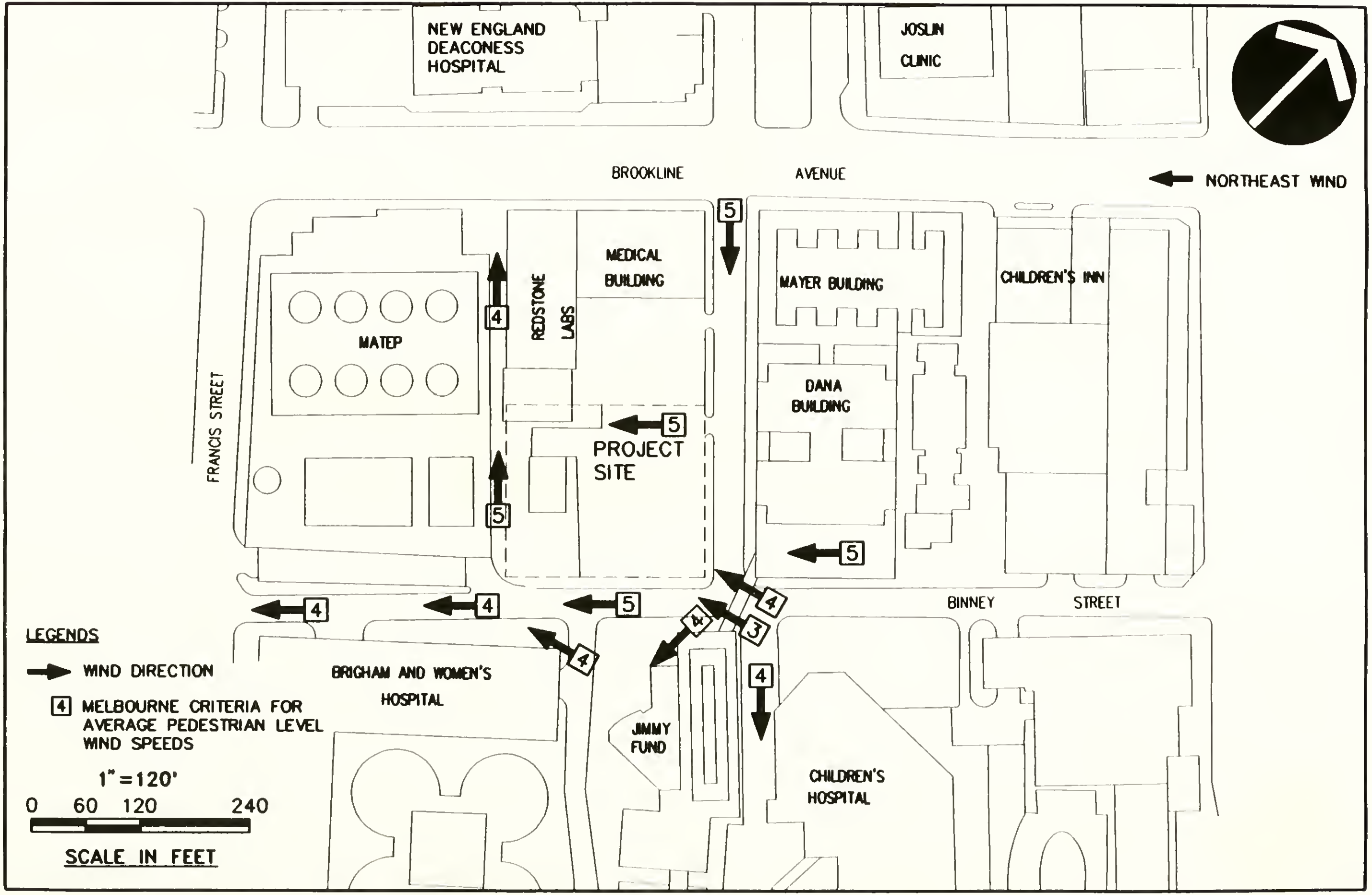

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FIGURE V.1-7
EXISTING NORTHEAST WINDS
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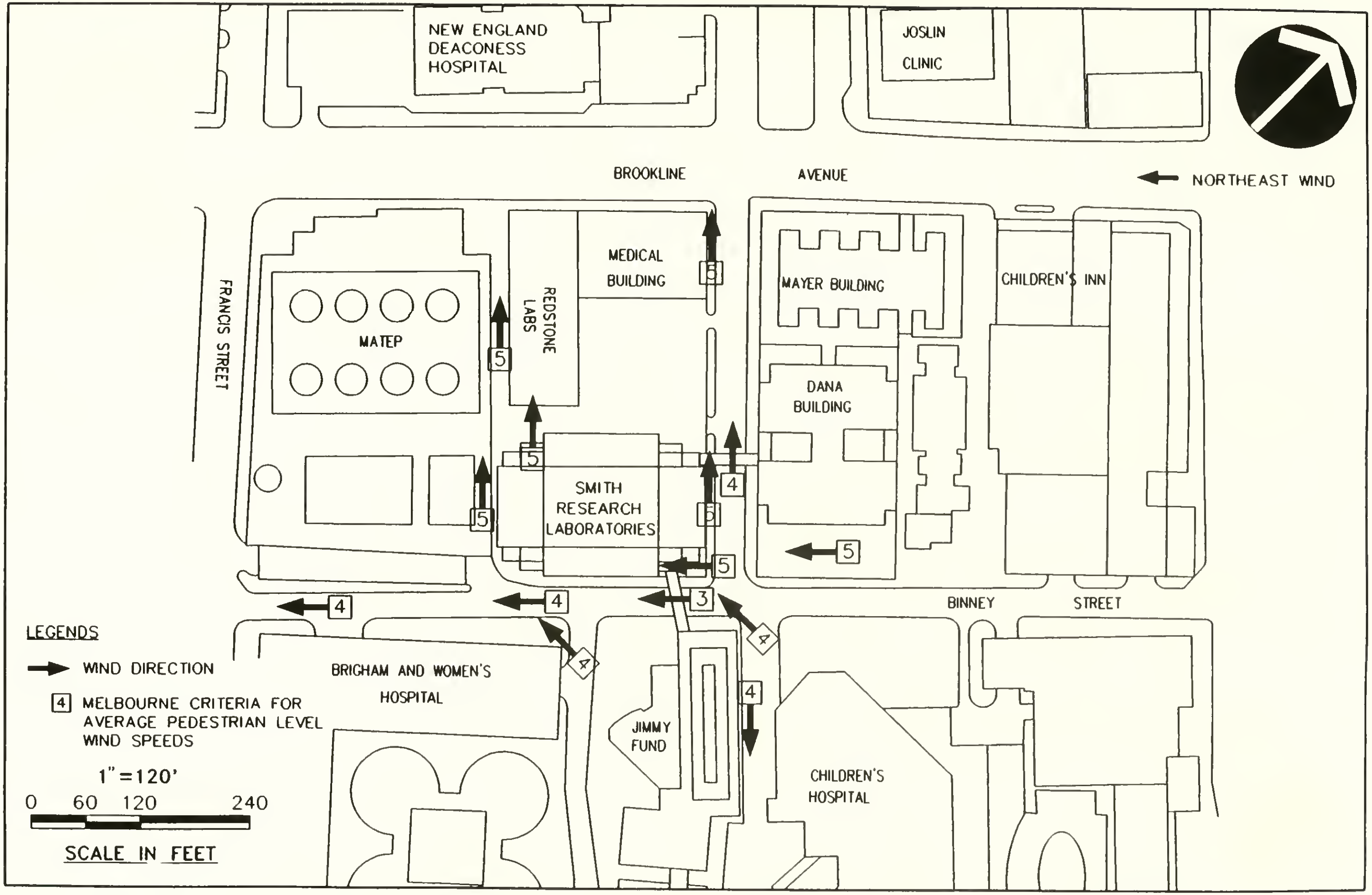

FIGURE V.1-8
BUILD NORTHEAST WINDS
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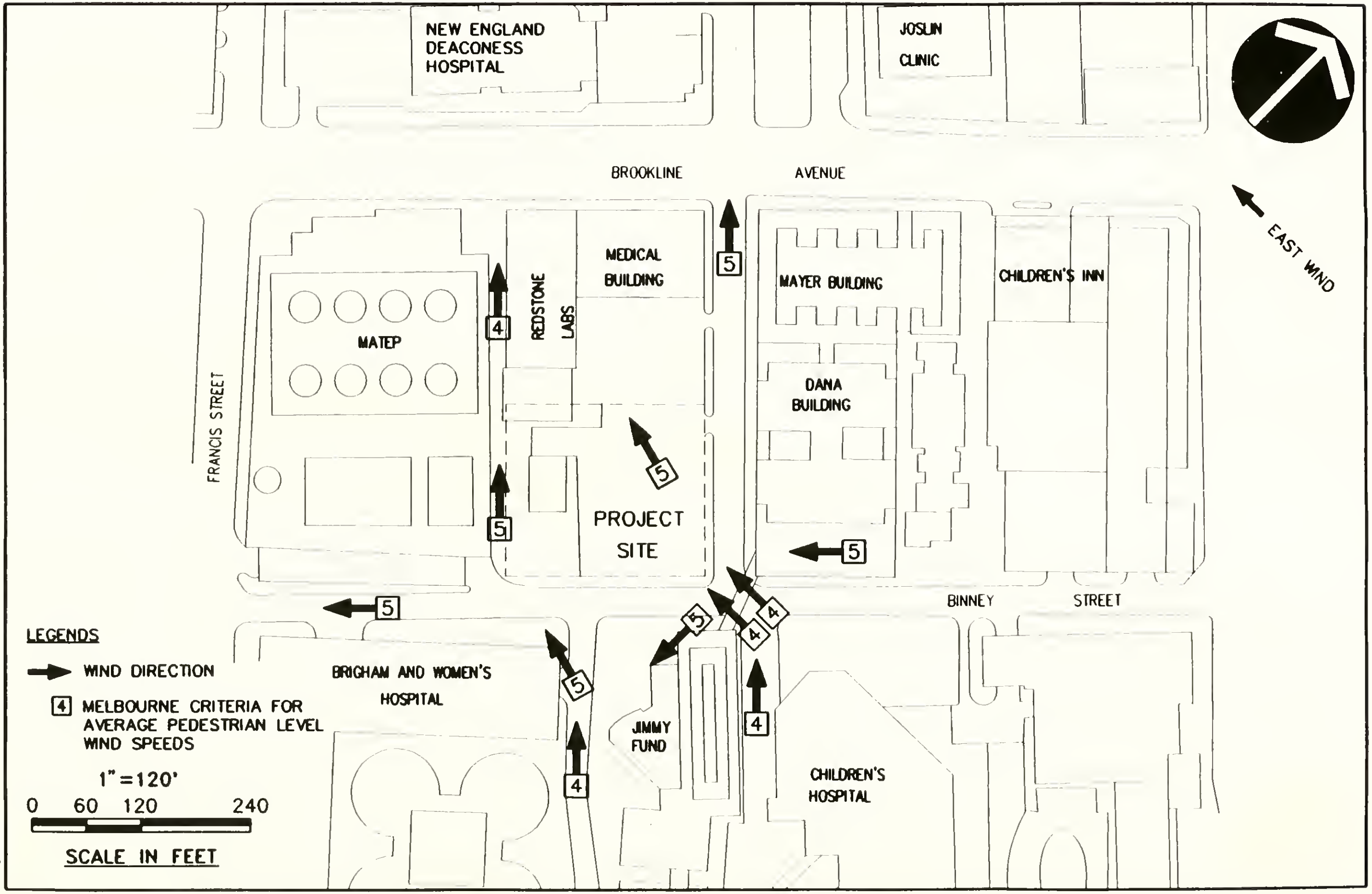

FIGURE V,1-9
EXISTING EAST WINDS
SMITH RESEARCH LABORATORIES

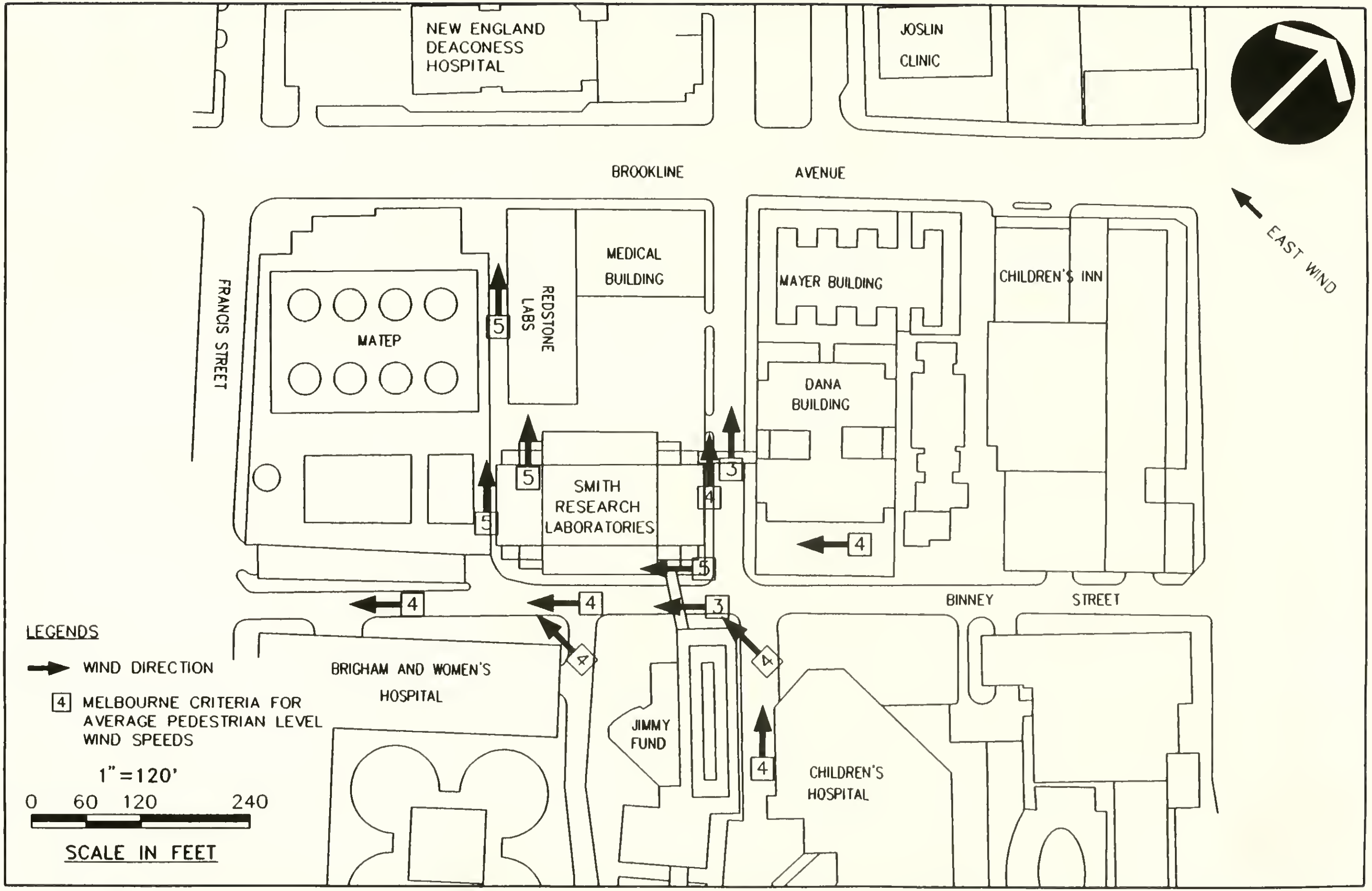

FIGURE V.1-10
BUILD EAST WINDS
SMITH RESEARCH LABORATORIES

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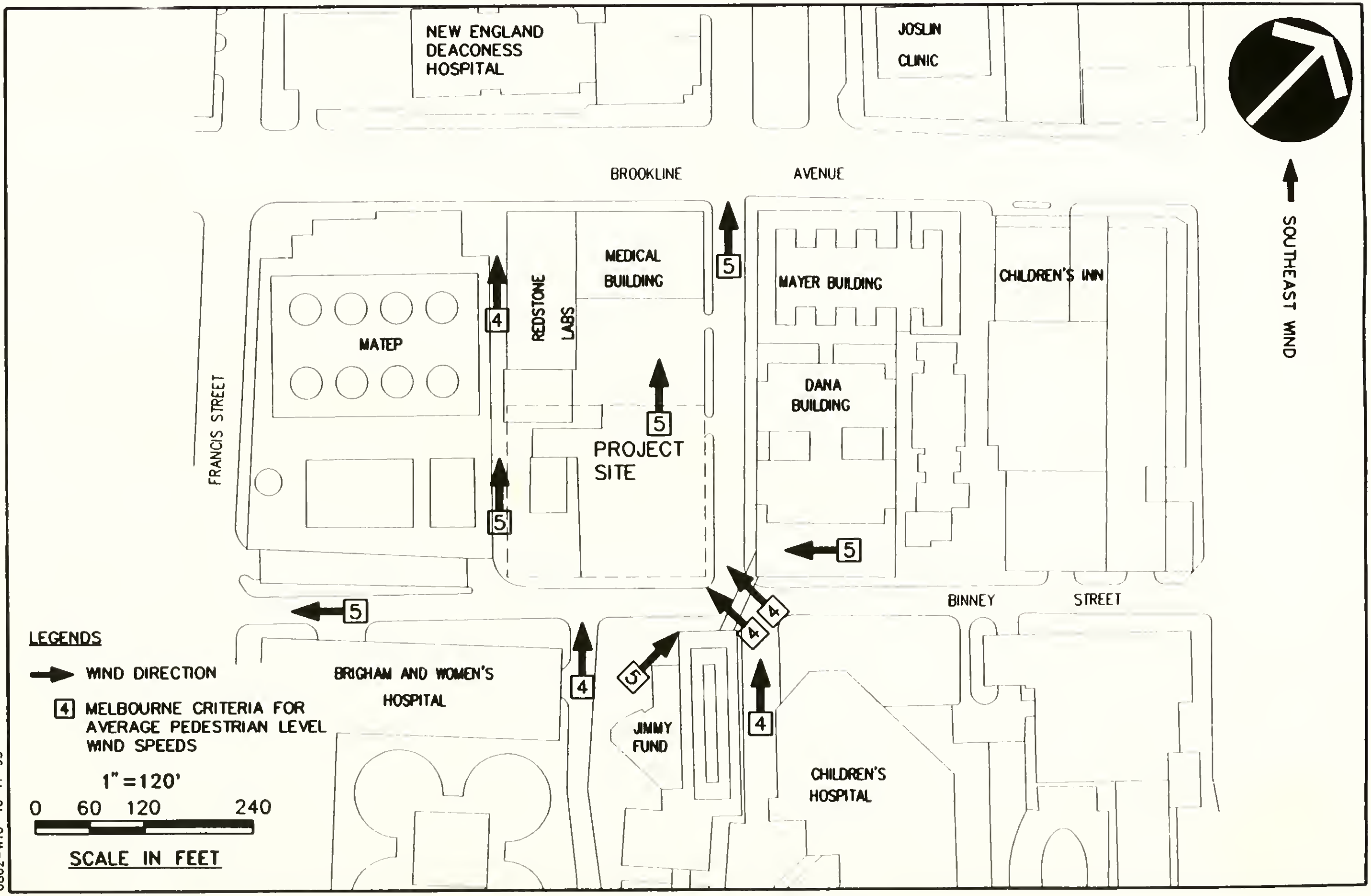

FIGURE V.1-11
EXISTING SOUTHEAST WINDS
SMITH RESEARCH LABORATORIES

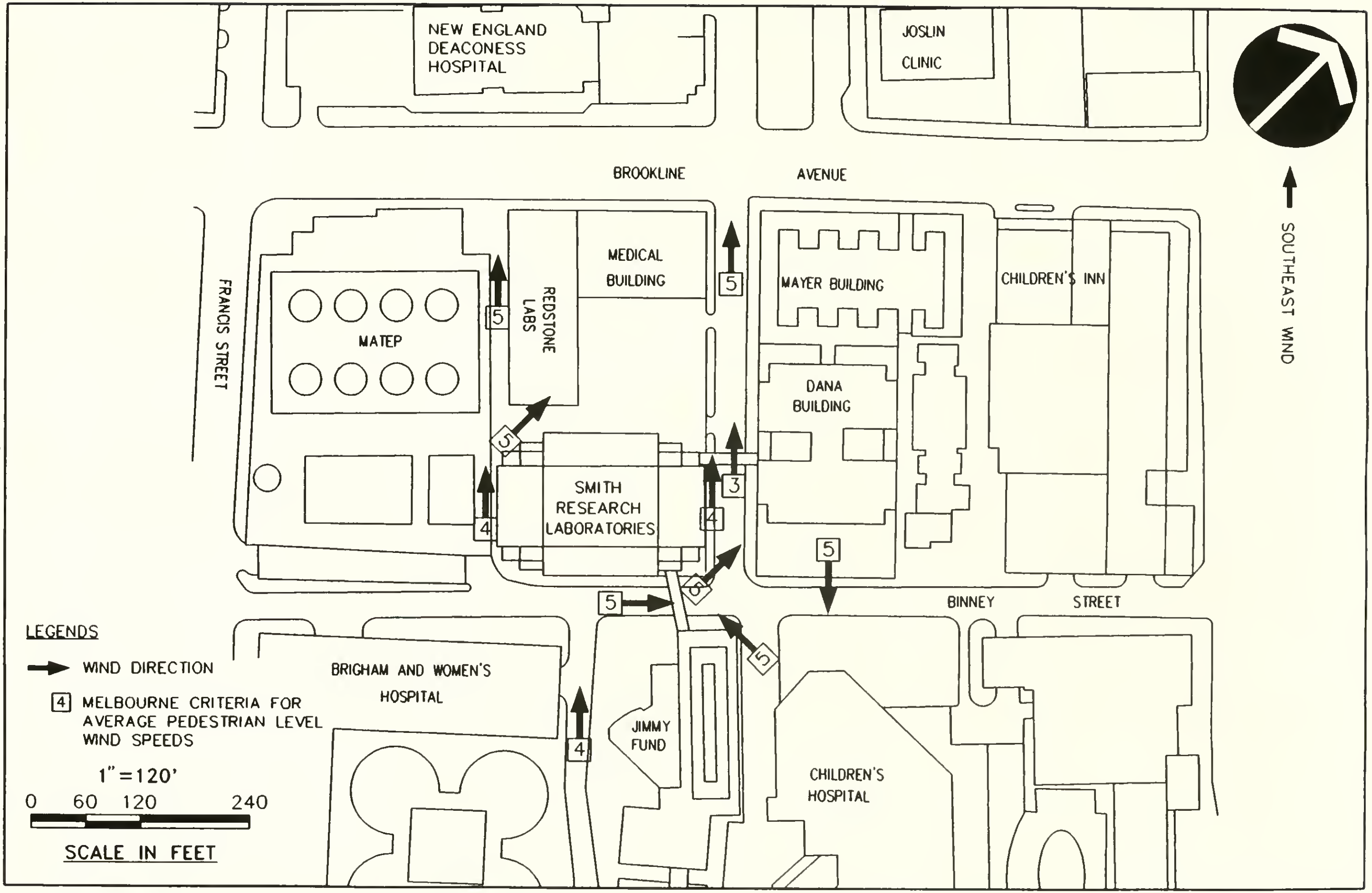

FIGURE V.1-12
BUILD SOUTHEAST WINDS
SMITH RESEARCH LABORATORIES

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1.3.3.2 Easterly Winds for Build Conditions

With the Smith Research Laboratories in place, the northeast winds coming down Binney Street will be squeezed between the new building and the Jimmy Fund Building. Winds under the bridge connecting these two buildings will probably increase to high Category 3, but winds at the intersection of Binney Street and Deaconess Road will be reduced due to the removal of the diagonal bridge. Winds at the Jimmy Fund entrance off Deaconess Road will also increase to high Category 4.

Winds at all four entrances to the Smith Research Laboratories are expected to be light (Category 5). The same is also true for the walkway next to the MATEP facility. Winds at the Deaconess Road entrance to 454 Brookline Avenue will be unaffected.

With east winds, conditions at the entrance to the Jimmy Fund Building will be unchanged. There may be some windiness at the main and secondary entrances to the Smith Research Laboratories on Deaconess Road (Category 4), but wind at all other entrances will be calm (Category 5). Winds under the new bridge across Binney Street will be in Category 3. Winds in the walkway next to the MATEP facility will be unchanged or reduced.

For southeast winds there will again be some windiness at the main entrance to the Smith Research Laboratories on Deaconess Road (Category 4). Winds in the walkway next to the MATEP facility near Brookline Avenue will decrease from Category 4 to 5. Between MATEP and the Project, winds will increase from Category 5 to 4. It also appears likely that the Smith Research Laboratories will cause wind to go down Binney Street toward Francis Street (high Category 4). Winds at all entrances to the Smith Research Laboratories are expected to be in Category 4 or 5.

1.4 Conclusions

Currently the Project site is open and is quite sheltered from winds from any direction because of the many surrounding buildings three to 20 stories high. There is no place at the site or in the immediate vicinity that has excessive PLWs. The Smith Research Laboratories will be similar in height to many of the surrounding buildings and thus is not expected to have serious adverse effects on PLWs at or near the site.

The site will remain sheltered from easterly storm winds, and for southwest summer winds. For northwest winds, the Smith Research Laboratories may cause some added windiness along Deaconess Road under the proposed bridge. The main pedestrian entrance to the Smith Research Laboratories in

the revised design will be about 45 feet nearer to Binney Street, and PLWs there will be light. The most notable effect from winds surrounding the site is expected to occur in the walkway next to the MATEP facility where, for northwest winds, PLWs may increase to high Category 3 near the west corner of the Project. However, this area will remain suitable for its intended use, walking.

All entrances to the Smith Research Laboratories will have winds in Category 4 or 5, and winds at the main entrance to the existing Dana Building, which currently are in Category 5 will be unaffected. The Project will probably reduce some of the current windiness along Binney Street in front of the Jimmy Fund Building. With the removal of the diagonal bridge across the intersection of Binney Street and Deaconess Road, winds at that location will also be reduced. Winds under the replacement bridge on Binney Street will be in Category 3, comfortable for walking.

Overall, all PLWs surrounding the site will remain comfortable for walking and winds at some locations will be reduced with the Project.

2.0 SHADOWS

The BRA requested that the shadow diagrams presented in the DPIR/DEIR be refined based on the revised Project design currently proposed. The BRA also requested that additional shadow diagrams for a number of time periods in autumn and winter be completed in order to evaluate new shadows on Joslin Park and the Windsor School playing fields at Longwood and Brookline Avenues. In addition to revisions to the DPIR/DEIR shadow studies, addressing shadow impacts during the Vernal Equinox (March 21), Summer Solstice (June 21), Autumnal Equinox (September 21) and the Winter Solstice (December 21), shadow diagrams have been prepared for the following additional cases, in accordance with the PAD requirements:

- October 21 at 10:00 AM, 11:00 AM and 12:00 Noon
- November 21 at 10:00 AM, 11:00 AM and 12:00 Noon
- December 21 at 10:00 AM, 11:00 AM, 1:00 PM and 2:00 PM
- January 21 at 10:00 AM, 11:00 AM and 12:00 Noon
- February 21 at 10:00 AM, 11:00 AM and 12:00 Noon

The changes in the revised design that potentially could alter the shadow studies are the reduced height of the building (10 feet) and the shifting of the building mass slightly closer to Brookline Avenue leading to an additional 12 feet of building setback along Binney Street. However, these changes resulted in virtually no change in the extent of new shadows from those presented in the DPIR/DEIR, since the reduced height of the building was offset by shifting the building slightly closer to Brookline Avenue. The Project's shadow effects are described in the following sections. Revised DPIR/DEIR figures and the new graphic figures presented are distinguished by contrasting shading patterns.

2.1 Shadow Sensitive Locations

The areas most sensitive to additional shadows created by the Project are those open areas where people may congregate to relax outdoors during fair weather conditions. Other locations as identified by the Boston Environment Department include the historic properties in the vicinity of the Project. The open spaces identified and discussed in this analysis are shown in Figure V.2-1. The Project's revised design also includes a plaza along the west side of the building.

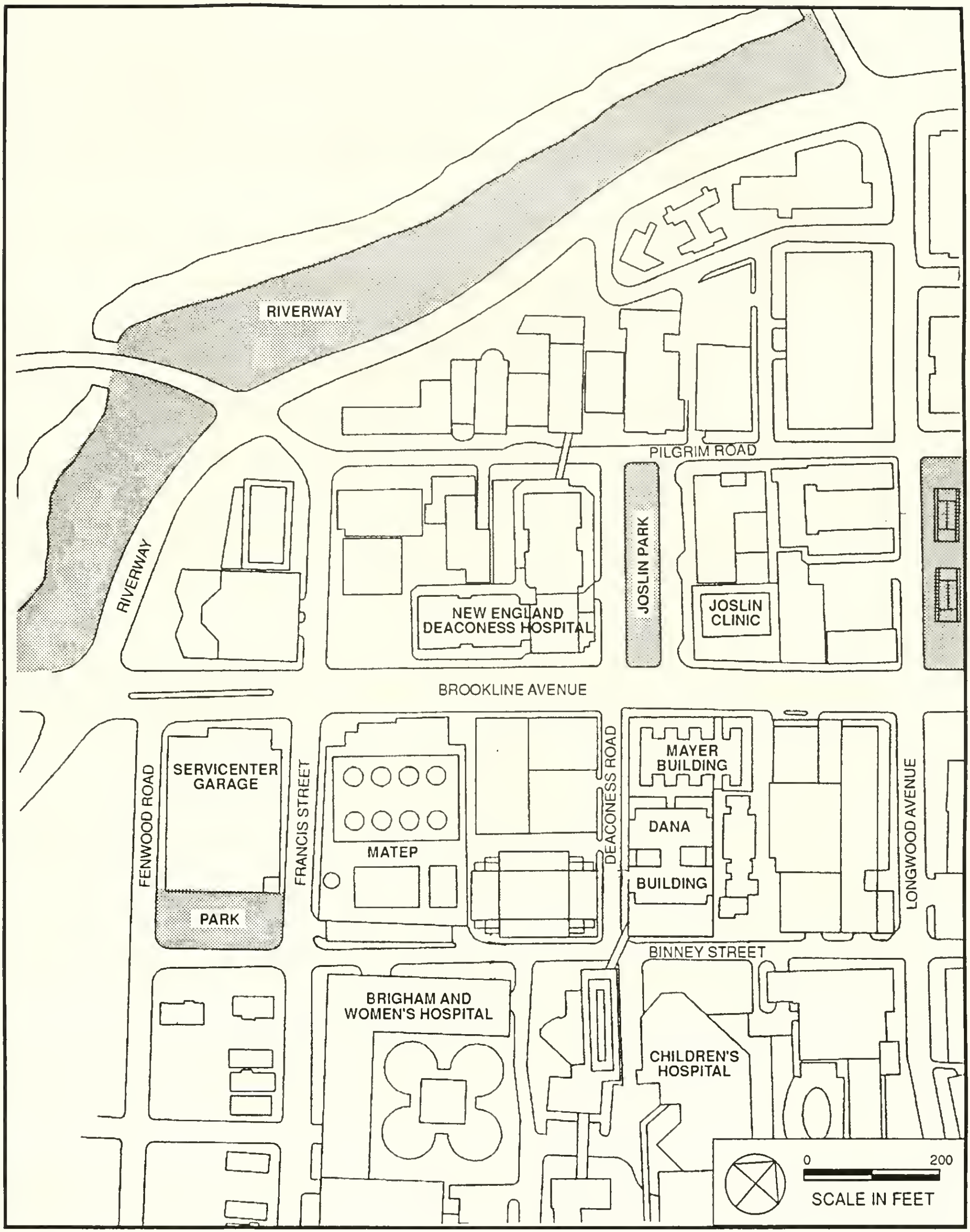

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FIGURE V.2-1
SHADOW SENSITIVE AREA
SMITH RESEARCH LABORATORIES

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The impact of new shadows on sensitive areas (e.g., Joslin Park) would be most significant in the spring, summer, and fall (through October). During other periods of the year when the weather is colder, some use of these areas may occur on a limited basis during the midday hours (12:00 noon to 2:00 PM).

The effects of new shadows created by the Project are discussed below.

2.2 Vernal Equinox - March 21 (9:00 AM, 12:00 Noon and 3:00 PM)

Shadow diagrams for the Vernal Equinox are shown in Figures V.2-2 through V.2-4. The morning shadow diagram indicates that new shadows will be extend over some of the 454 Brookline Avenue parking lot and building, the Redstone Building and across a portion of Brookline Avenue.

By noon, new shadows are confined to the adjacent parking lot and a portion of Deaconess Road. By mid-afternoon, existing shadows affect most of Joslin Park and the former Massachusetts College of Art Building. New shadows from the Project will extend across a portion of Deaconess Road toward the Dana Building and on a section of the Binney Street sidewalk up to the Longwood Galleria.

During the time periods evaluated for the Vernal Equinox, none of the off-site sensitive areas identified on Figure V.2-1 will be affected by new shadows from the Project although the on-site plaza along the west side of the Project will be shaded.

2.3 Summer Solstice - June 21 (9:00 AM, 12:00 Noon and 3:00 PM)

Figures V.2-5 through V.2-7 show the extent of shadows during the Summer Solstice. In the summer months when solar altitude angles are high, new shadows are small in extent and limited to the block itself.

During summer mornings, new shadows occur primarily on the Redstone Building and MATEP facility rooftops. All new shadows during the summer at 9:00 AM are confined to the Project's block.

During the summer noontime hour, all shadows, both existing and new, are very short due to the high solar altitude angle. Shadows from the Smith Research Laboratories extend to the northwest, onto a small area of the adjacent parking lot and the Redstone Building.

By 3:00 PM, new shadows extend to the northeast across Deaconess Road to the Dana Building corner.

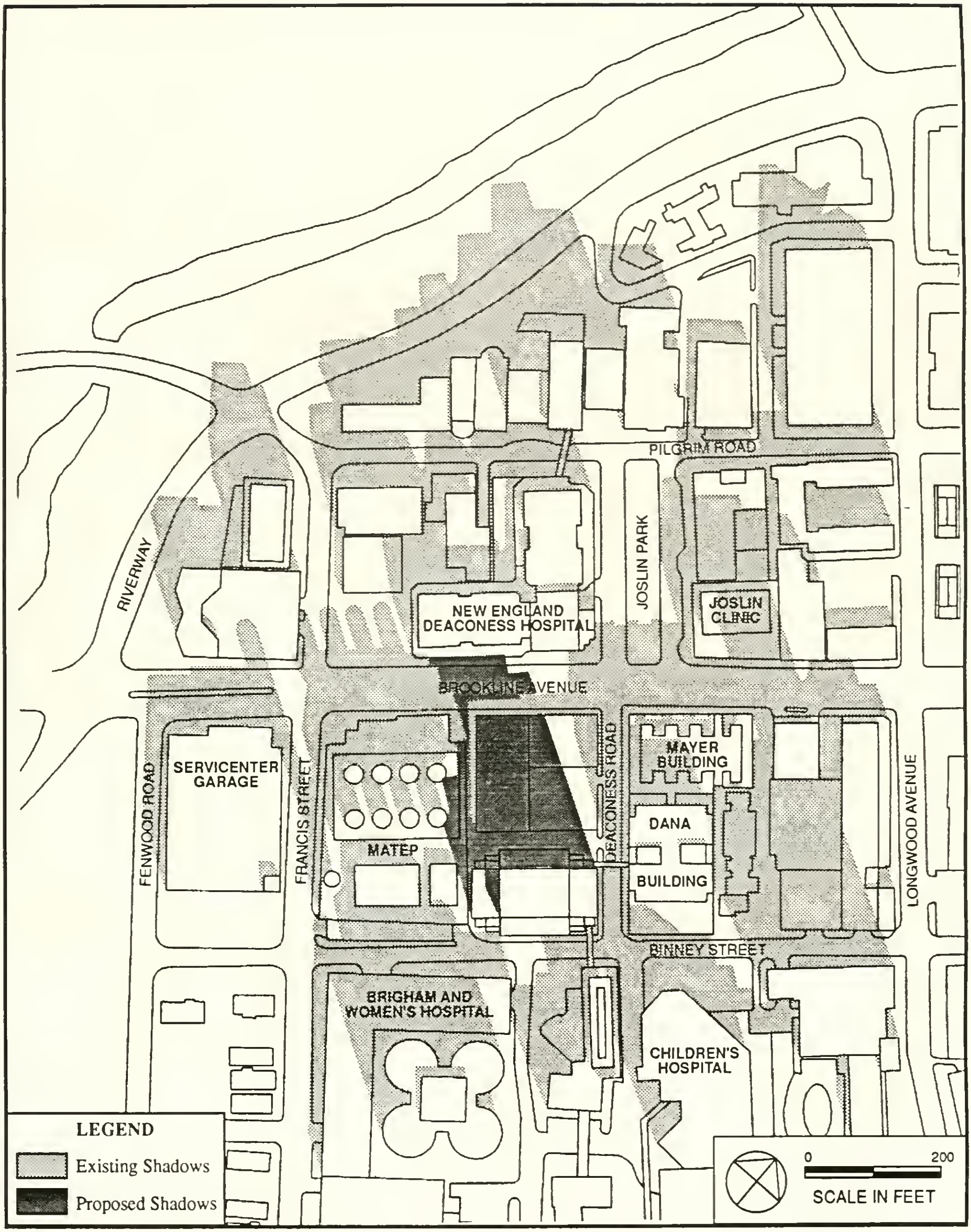

FIGURE V.2-2
MARCH 21, 9:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

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A Summit Company

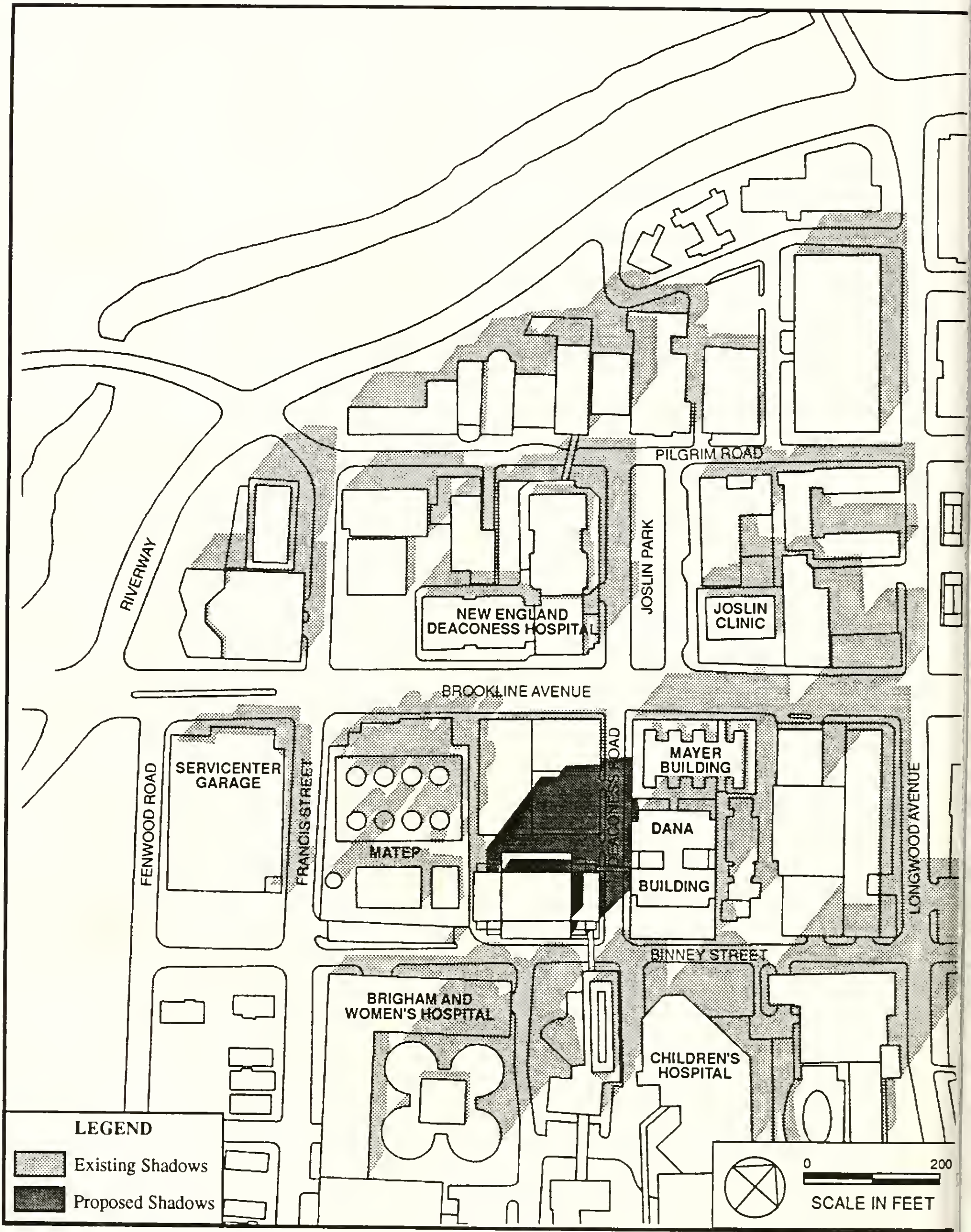

FIGURE V.2-3
MARCH 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

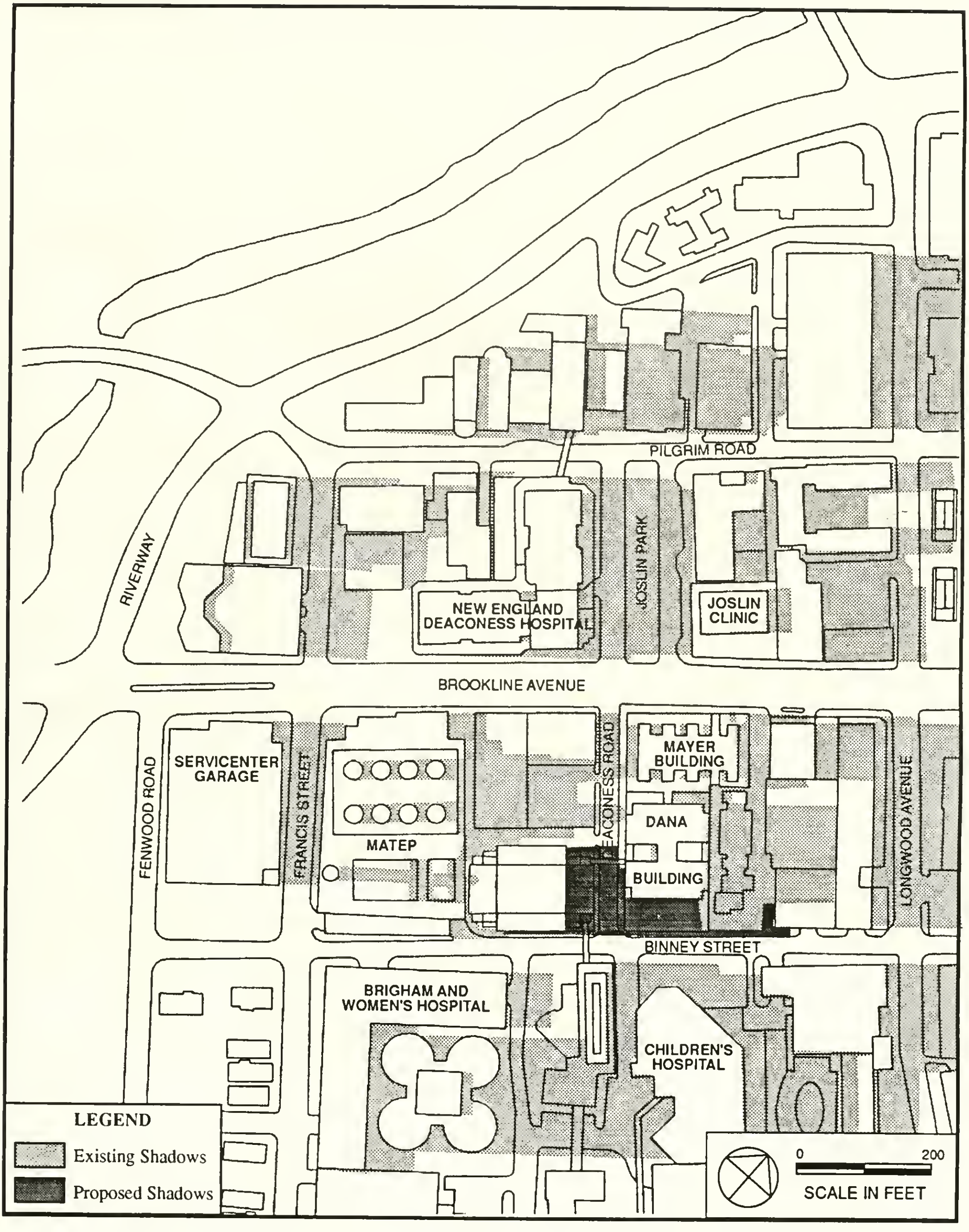

FIGURE V.2-4
MARCH 21, 3:00 PM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

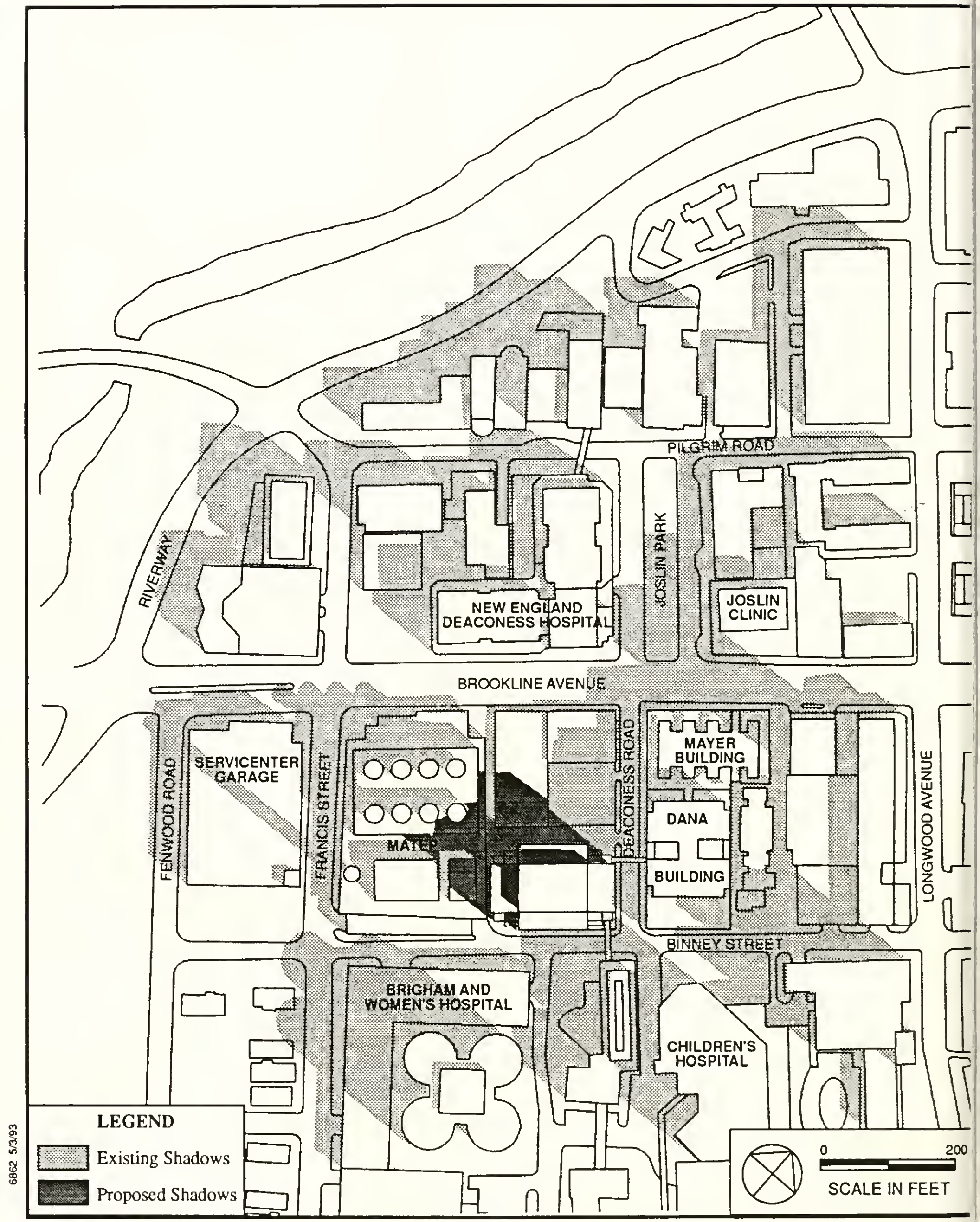

FIGURE V.2-5
JUNE 21, 9:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

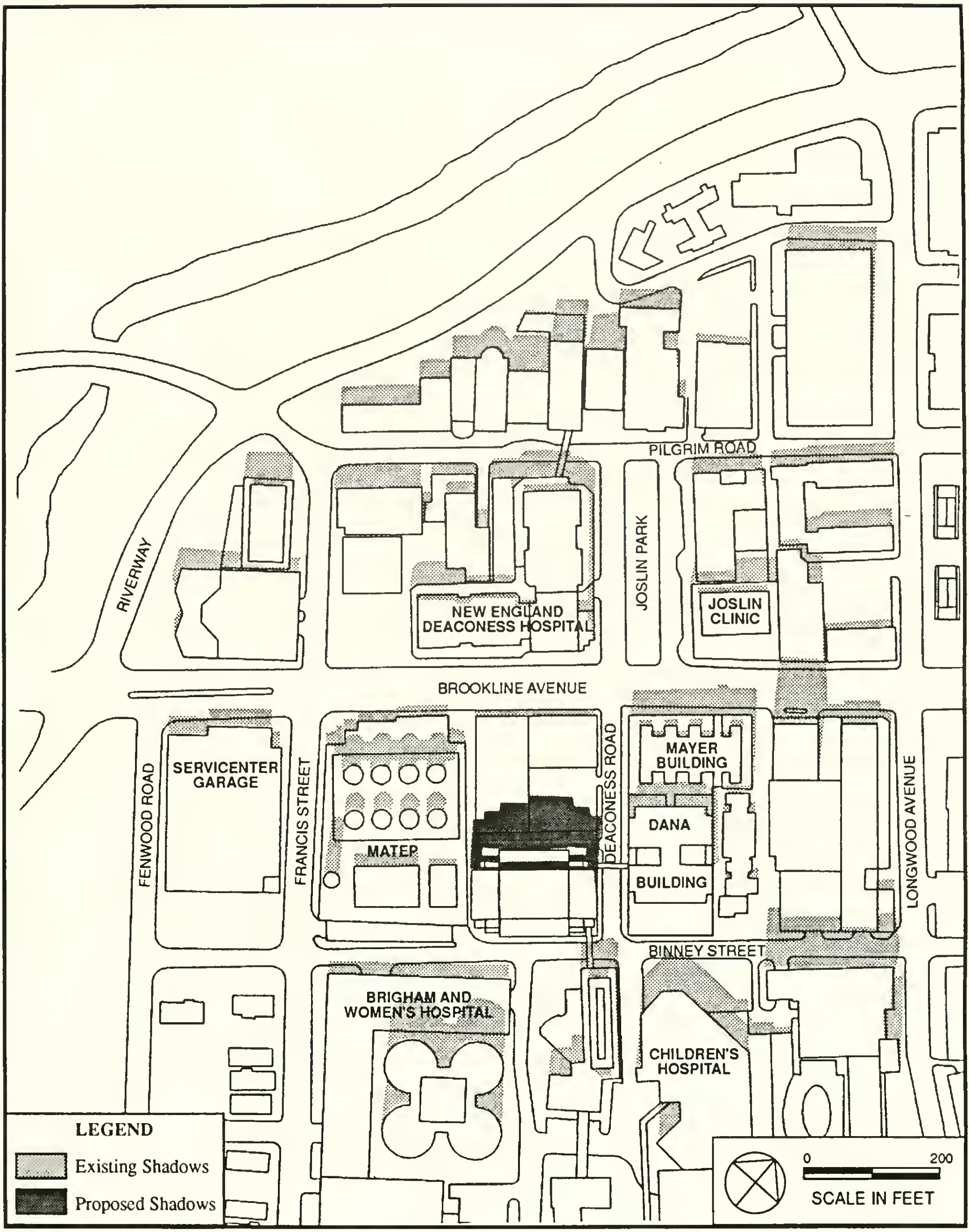

FIGURE V.2-6
JUNE 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

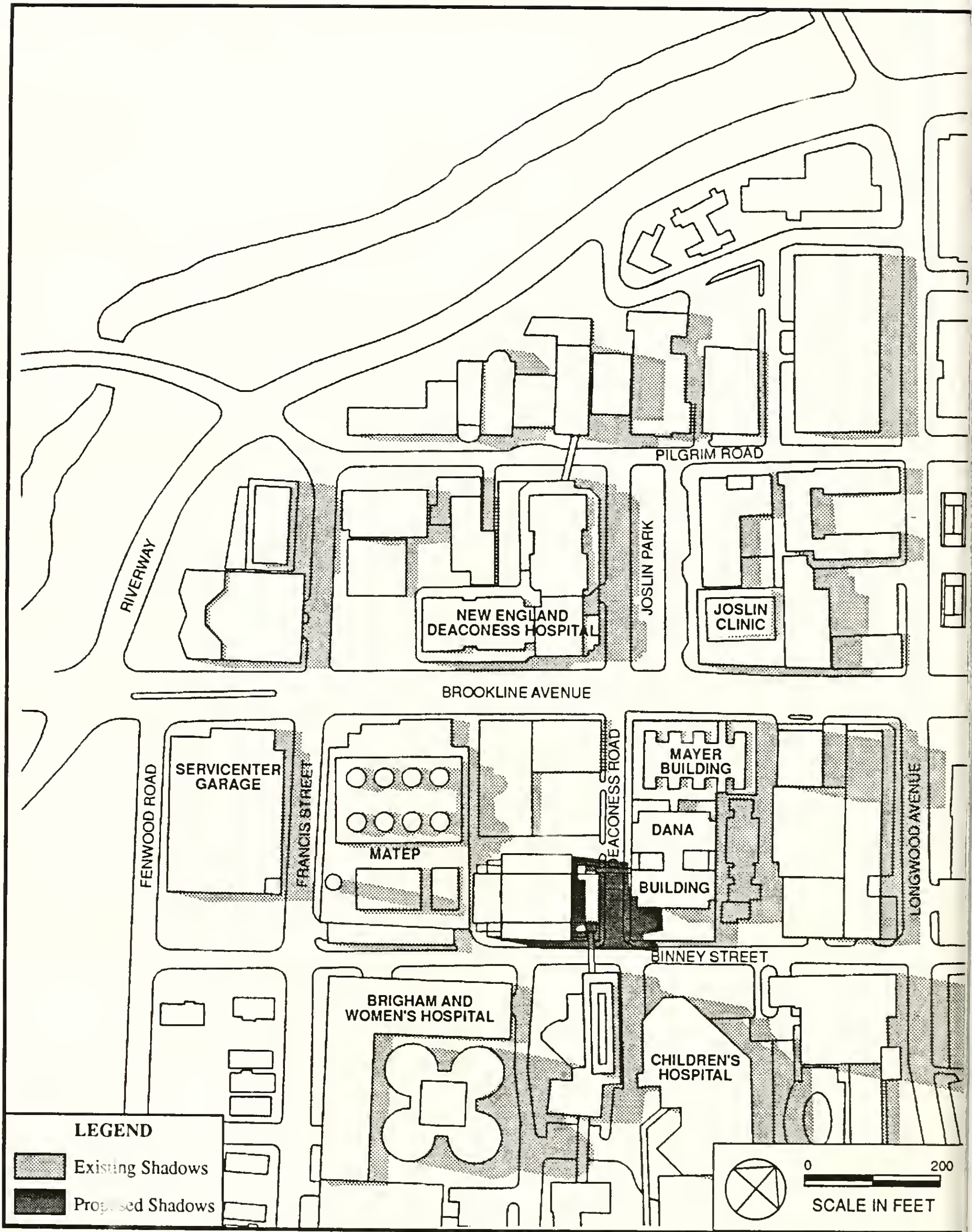

FIGURE V.2-7
JUNE 21, 3:00 PM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

During the Summer Solstice, the on-site plaza will be shaded by the Project during a portion of the day. Although some of the off-site open areas are currently shaded by existing buildings during the early morning and mid-afternoon, none of these areas are impacted by new shadows from the Project.

2.4 Autumnal Equinox - September 21 (9:00 AM, 12:00 Noon and 3:00 PM)

Figures V.2-8 through V.2-10 show the extent of shadows during the Autumnal Equinox. At 9:00 AM, the area is mostly shaded by existing buildings. New shadows are primarily limited to the Redstone Building and MATEP facility. Some new shadows also extend across a portion of Brookline Avenue onto the empty lot at the corner of Brookline Avenue and Francis Street.

By noon, shadows have progressed eastward and extend north onto a portion of Deaconess Road, the adjacent parking lot and a portion of the Redstone Building as well as the on-site plaza. In the mid-afternoon, new shadows are confined to a portion of Deaconess Road and Dana Building entrance canopy area.

Some of the off-site sensitive areas are currently shaded by existing buildings during the Autumnal Equinox, however, no new shading will result from the Project.

2.5 October 21 EDT (10:00 AM, 11:00 AM and 12:00 Noon)

Shadow diagrams for October 21 during the mid-morning to noon hours are shown in Figures V.2-11 through V.2-13.

During October, the overall area is heavily shaded by existing buildings. New shadows from the Project during the three time periods evaluated extend across the adjacent Redstone and 454 Brookline Avenue Buildings, and across Brookline Avenue (although not beyond Brookline Avenue). Aside from the on-site plaza, no off-site open areas are affected by the Project.

2.6 November 21 (10:00 AM, 11:00 AM and 12:00 Noon)

Figures V.2.14 through V.2-16 show the extent of shadows during the mid-to-late-morning hours on November 21.

At 10:00 AM, new shadows from the Project extend northwest across Brookline Avenue to an edge of Joslin Park and the adjacent Deaconess Road. Although shadows have become slightly shorter at 11:00 AM, new shadows

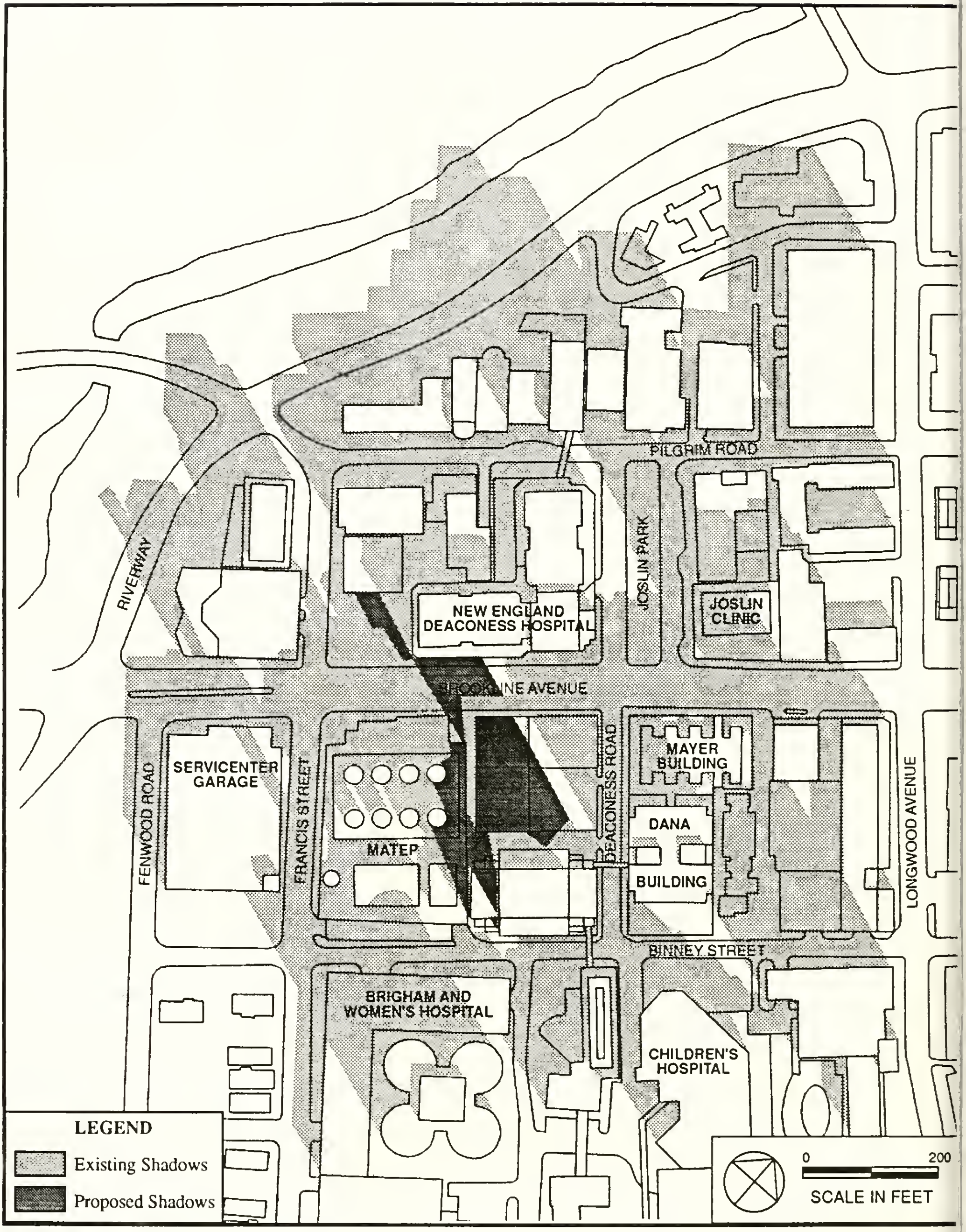

FIGURE V.2-8
SEPTEMBER 21, 9:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

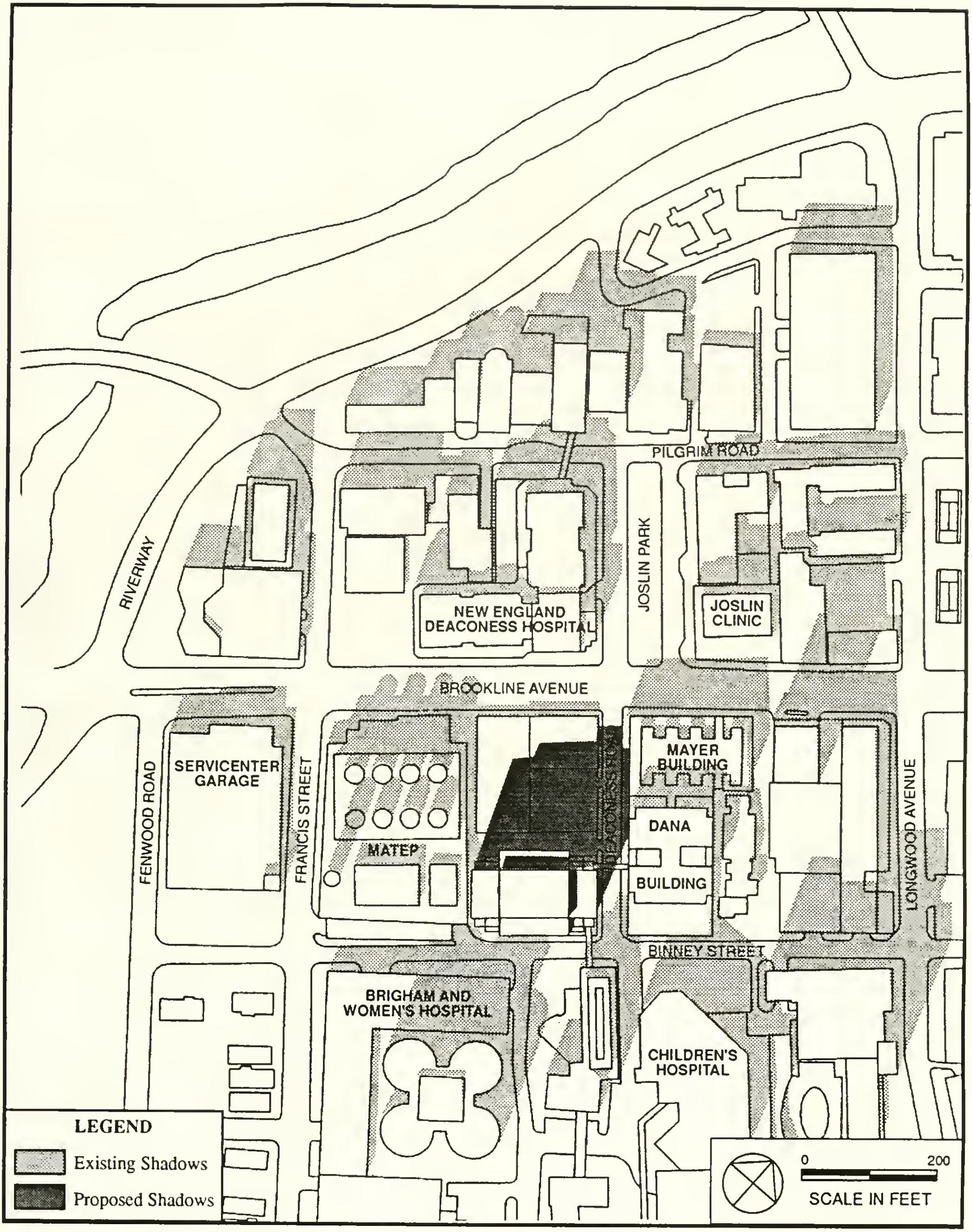

FIGURE V.2-9
SEPTEMBER 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

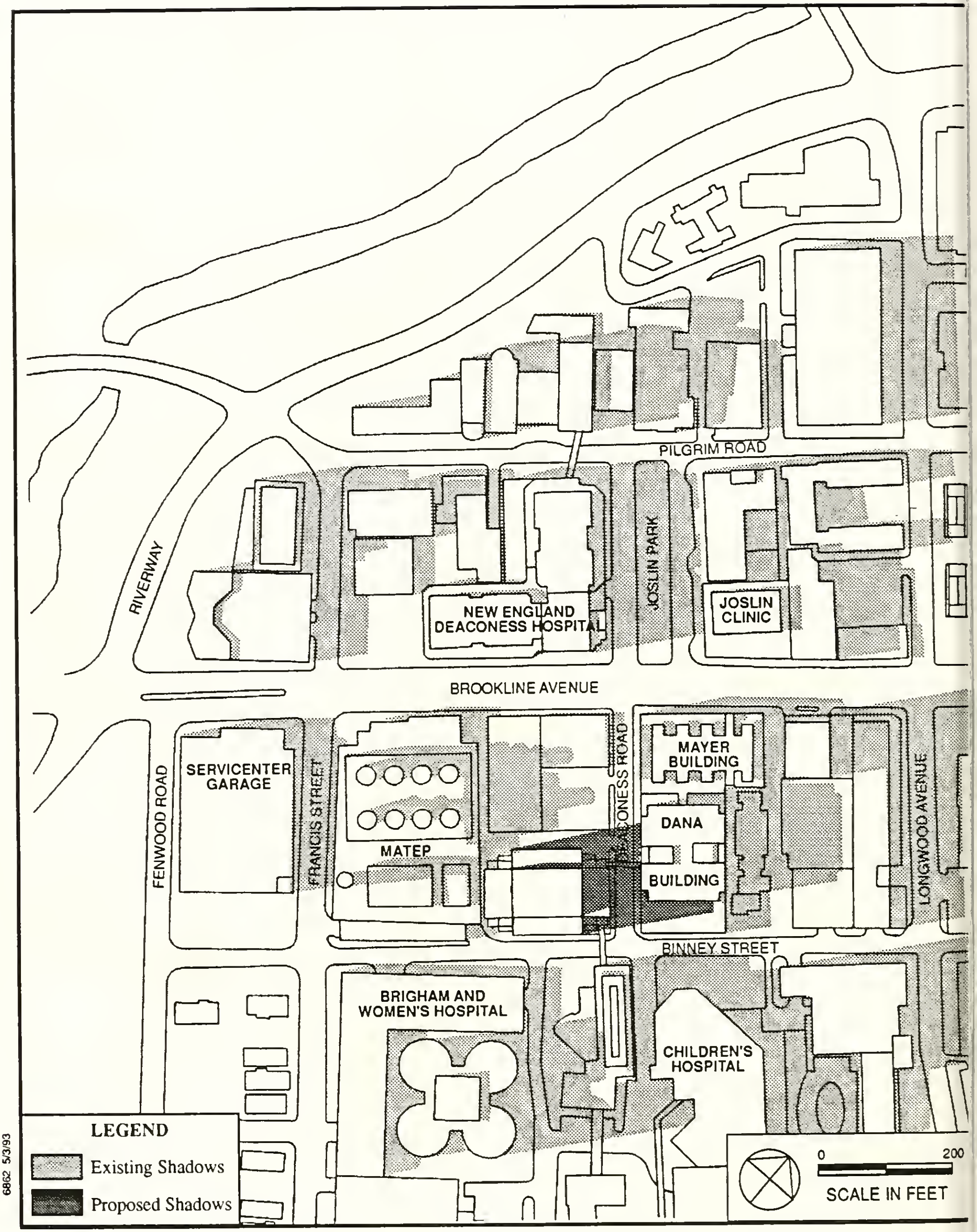

FIGURE V.2-10
SEPTEMBER 21, 3:00 PM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

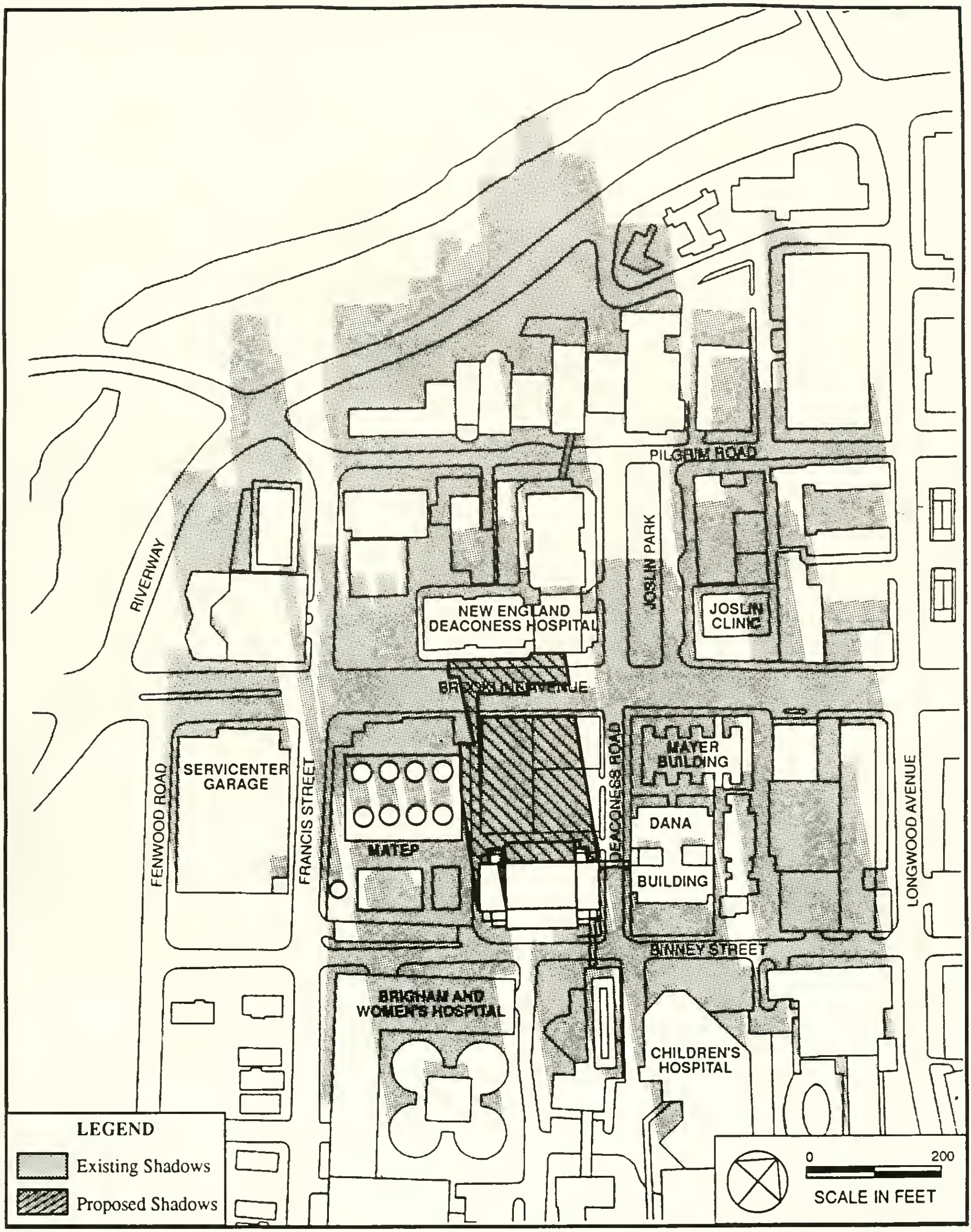

FIGURE V.2-11
OCTOBER 21, 10:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

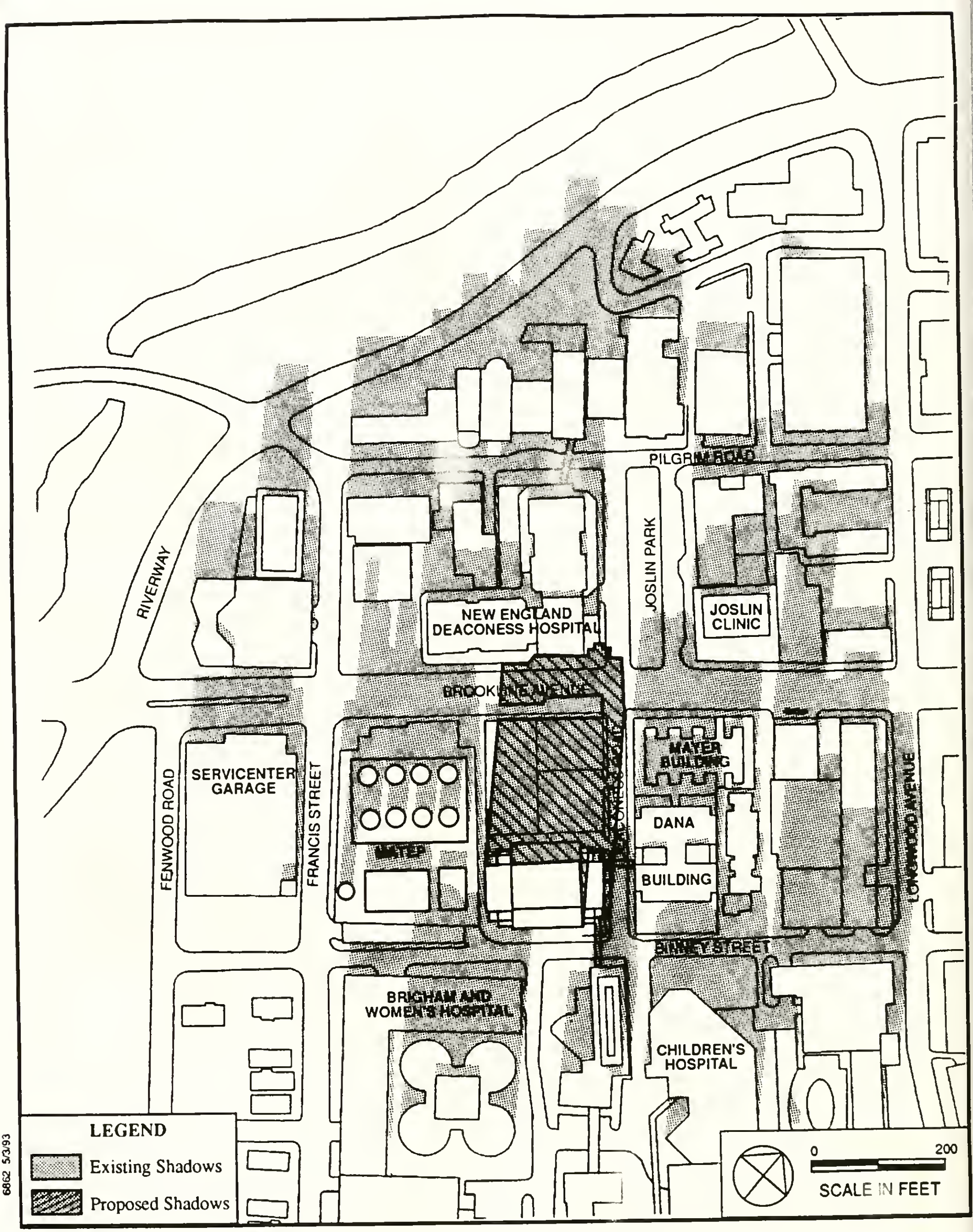

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FIGURE V.2-12
OCTOBER 21, 11:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

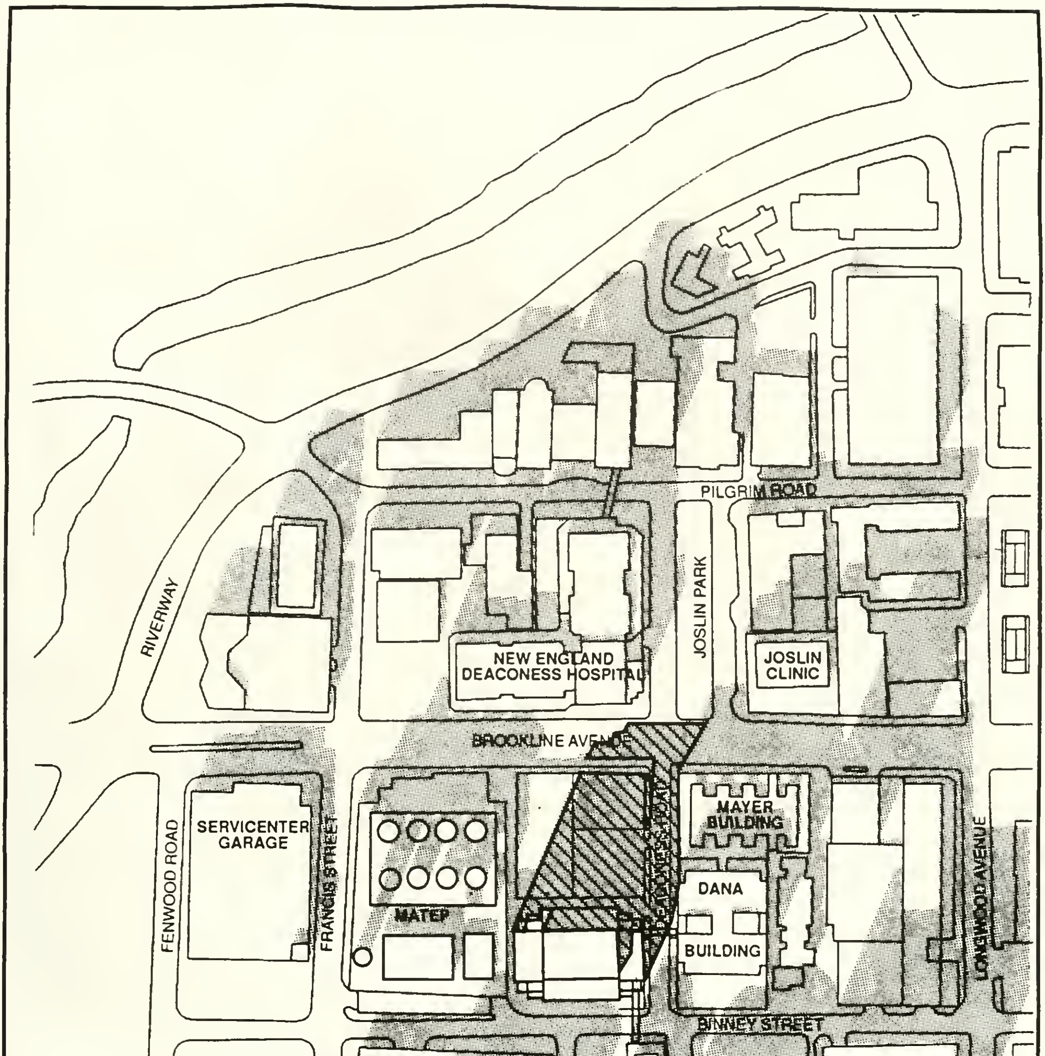

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FIGURE V.2-13
OCTOBER 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

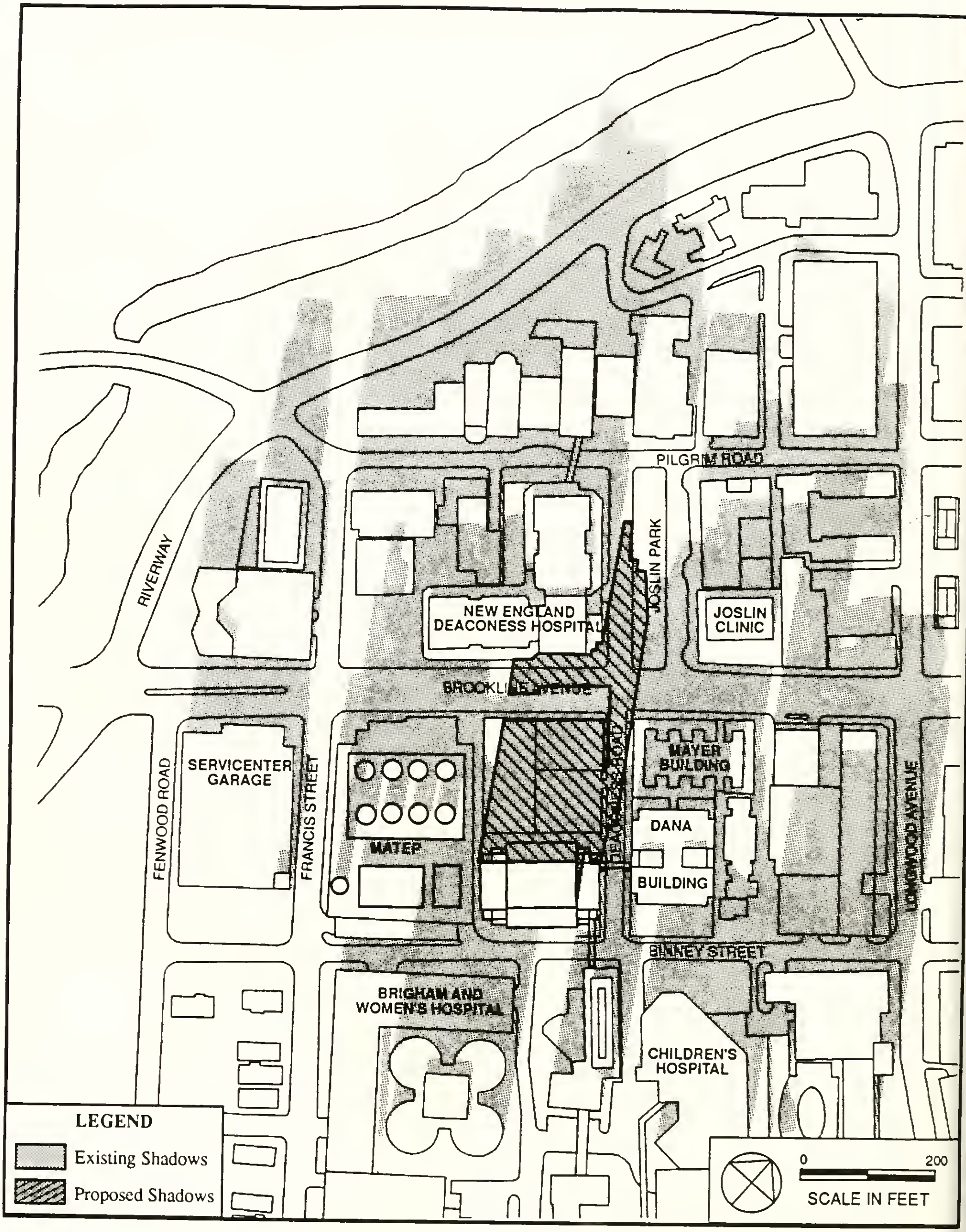

FIGURE V.2-14
NOVEMBER 21, 10:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

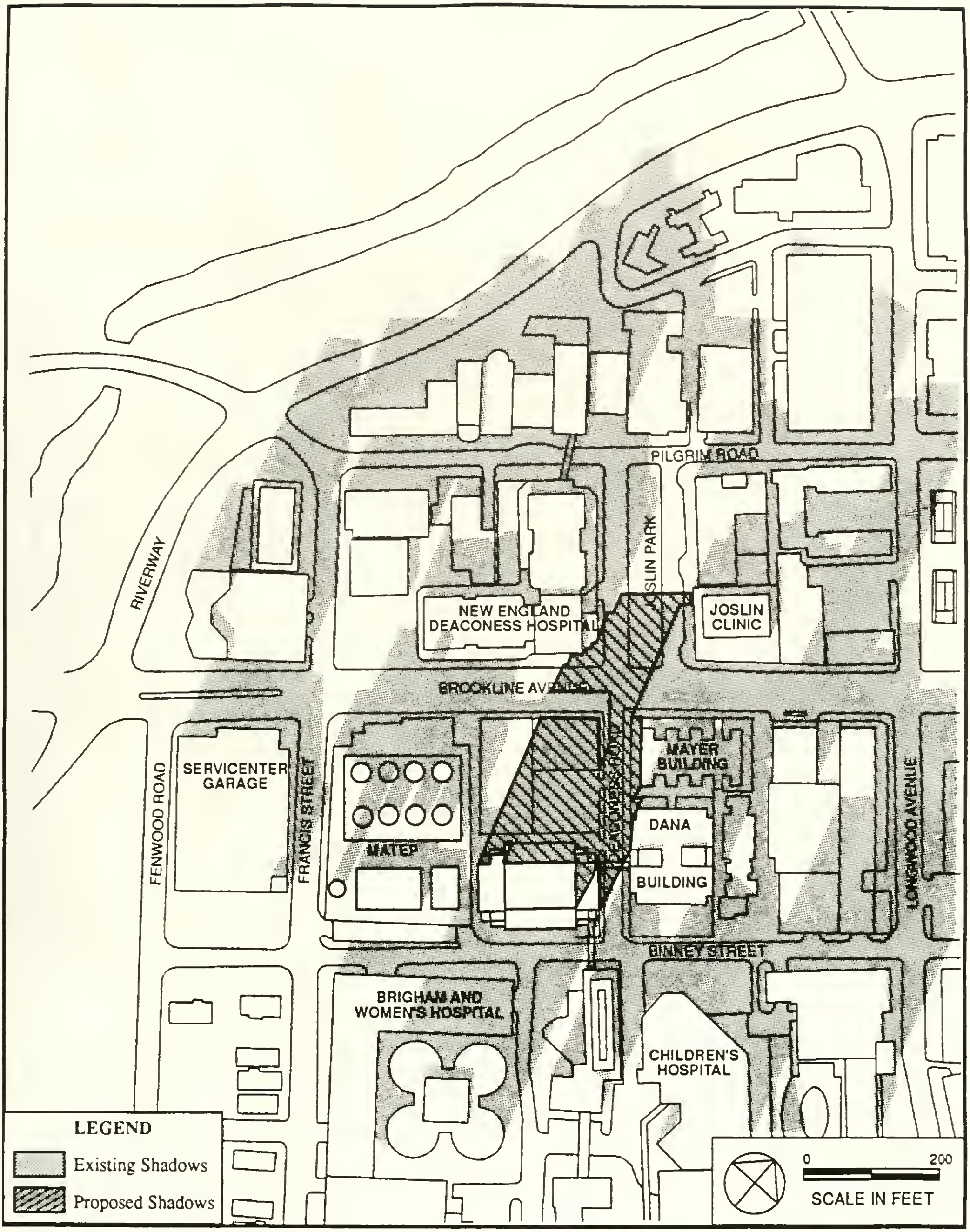

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FIGURE V.2-15
NOVEMBER 21, 11:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

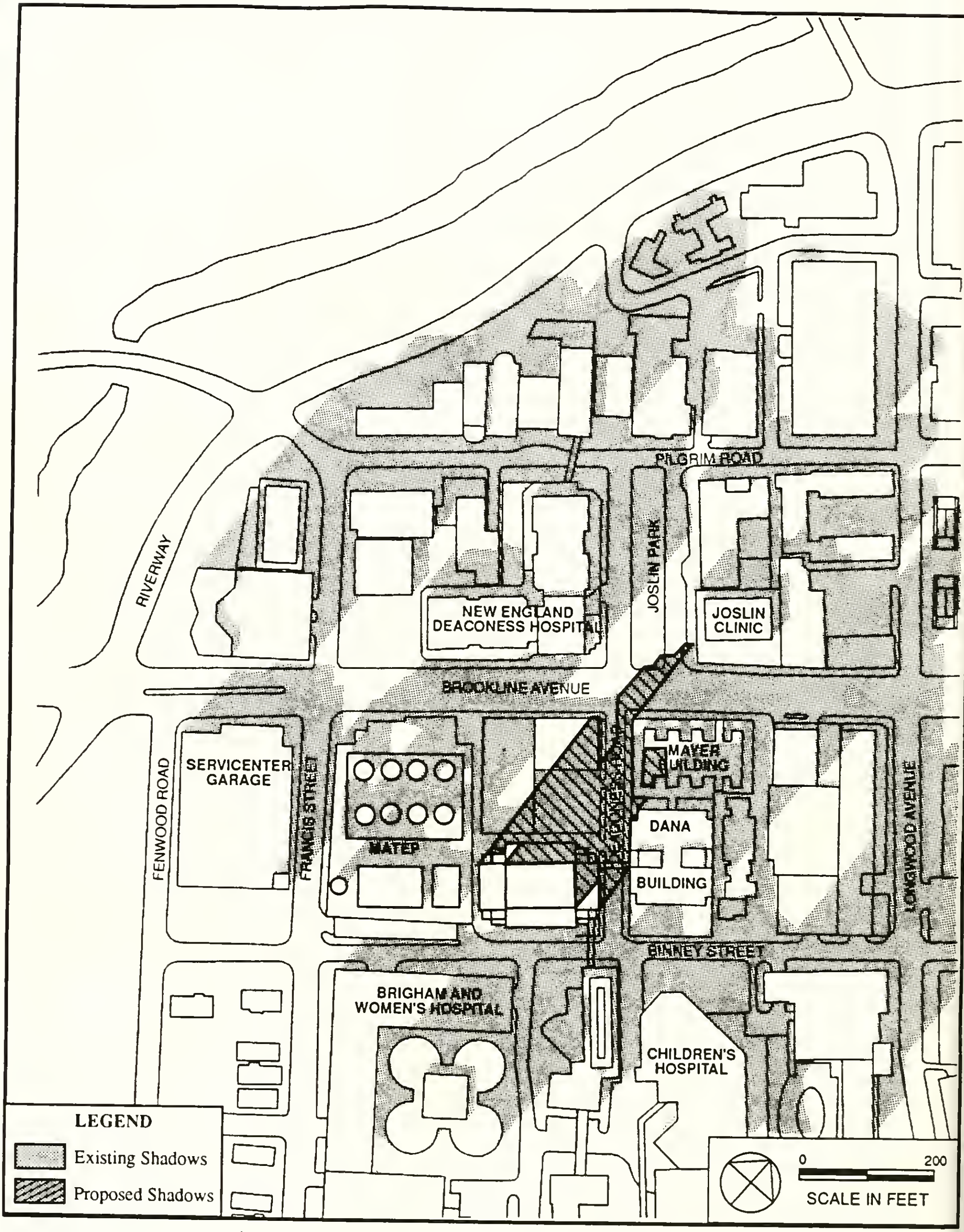

FIGURE V.2-16
NOVEMBER 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

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still extend over approximately one-third of Joslin Park. At that time, prior to the lunch hour when the park is not expected to be used as much, the park is also affected by existing shadows from the Deaconess Clinical Facility. By noon, shadows have shifted further to the north, resulting in a very small corner of Joslin Park being shaded by the Project.

2.7 Winter Solstice (December 21)

Figures V.2-17 through V.2-23 show the extent of shadows during the Winter Solstice from 9:00 AM to 3:00 PM in hourly increments. During winter, shadows reach their peak lengths due to the low solar altitude angles.

At 9:00 AM, much of this area is already shaded by existing buildings, including Joslin Park and the Riverway. New shadows from the Project extend over the adjacent Brookline Avenue buildings and over a portion of the New England Deaconess Hospital Clinical Facility currently under construction. New shadows are still not significant since existing buildings already cast extensive shadows in the area. Between 10:00 AM and 11:00 AM, most of Joslin Park is shaded by either existing or new shadows from the Project.

Noon shadows from the Smith Research Laboratories extend over Brookline Avenue, however, a very small corner of Joslin Park will be affected by new shadows.

At 1:00 PM and 2:00 PM, new shadows from the Project are limited to Deaconess Road immediately adjacent to the site and small portions of the Dana and Mayer Buildings.

Shadows at 3:00 PM are the longest of all cases evaluated. During this period, new shadows extend only to the Dana Building. Very little new shadows occur as existing buildings already shade much of the area.

During the Winter Solstice, a portion of Joslin Park will be affected by new shadows for approximately two hours in the morning (from 10:00 AM to 12:00 Noon). In general, most areas are already shaded by existing buildings surrounding the site.

2.9 January 21 (10:00 AM, 11:00 AM and 12:00 Noon)

Figures V.2-24 through V.2-26 show the extent of shadows during January 21, between 10:00 AM to 12:00 Noon. Based on these shadow diagrams, a portion of Joslin Park will be affected by new shadows for approximately two hours during the morning. At 12:00 Noon shadows from the Project have moved beyond the Park.

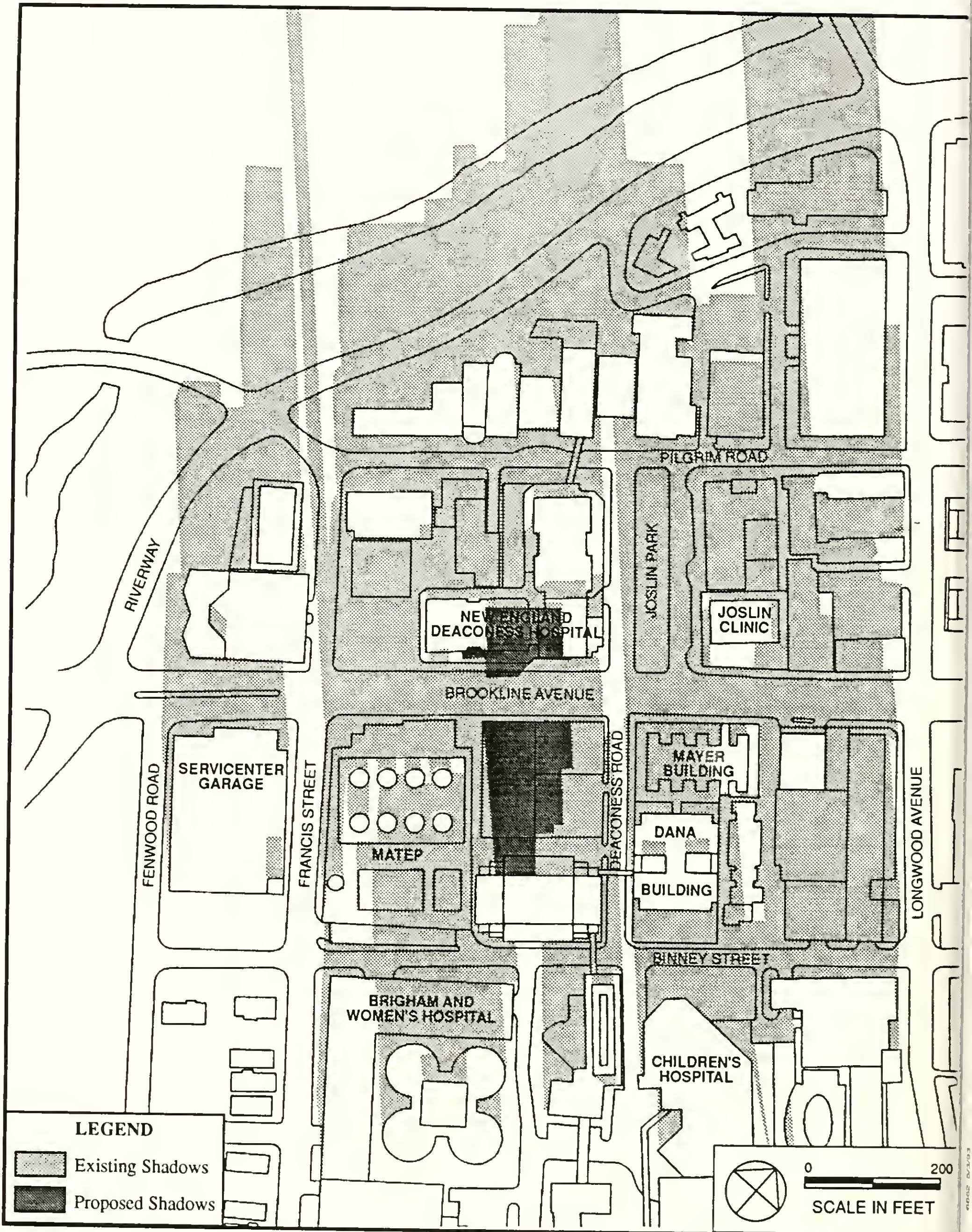

FIGURE V.2-17
DECEMBER 21, 9:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
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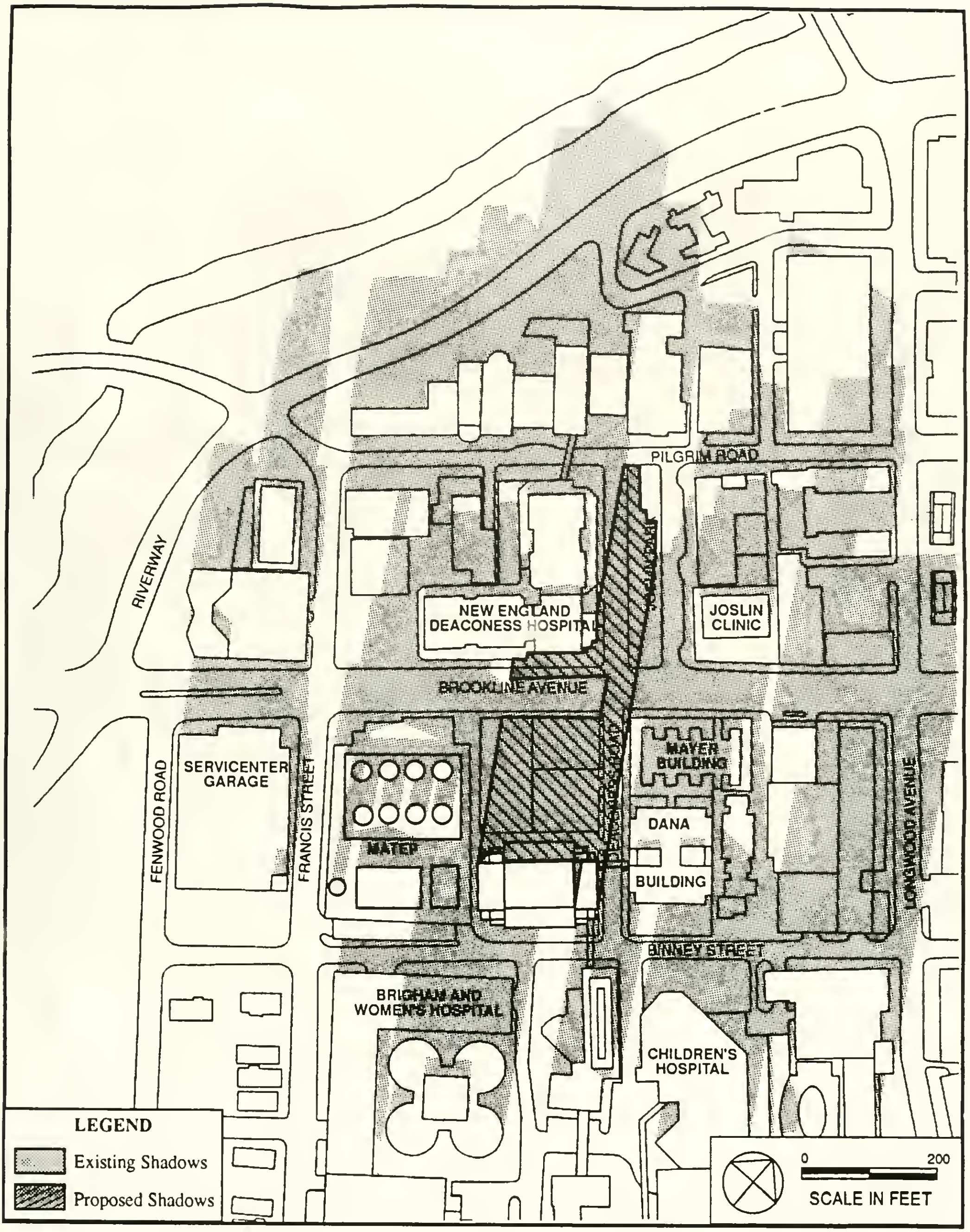

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FIGURE V.2-18
DECEMBER 21, 10:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

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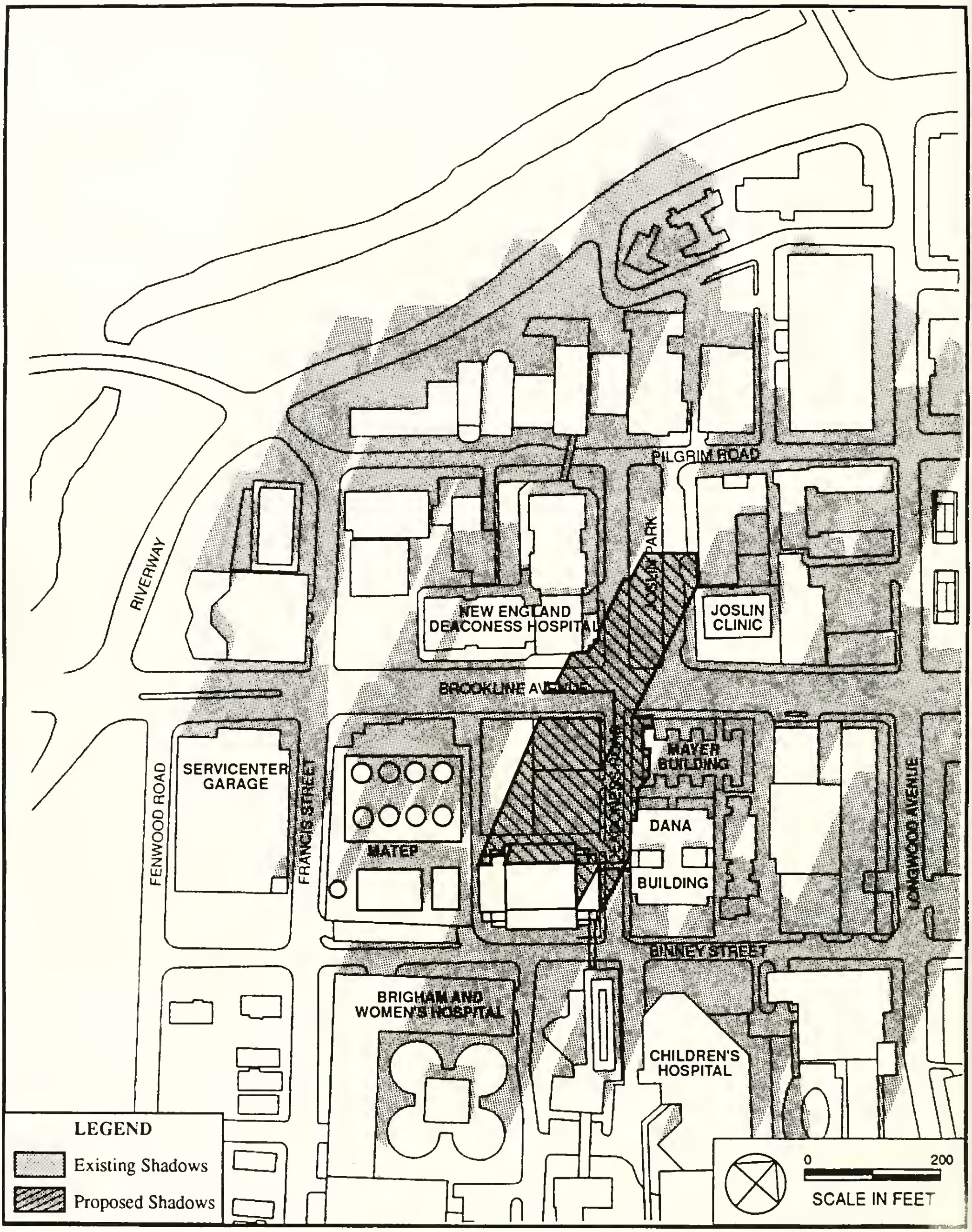

FIGURE V.2-19
DECEMBER 21, 11:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

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A Summit Company

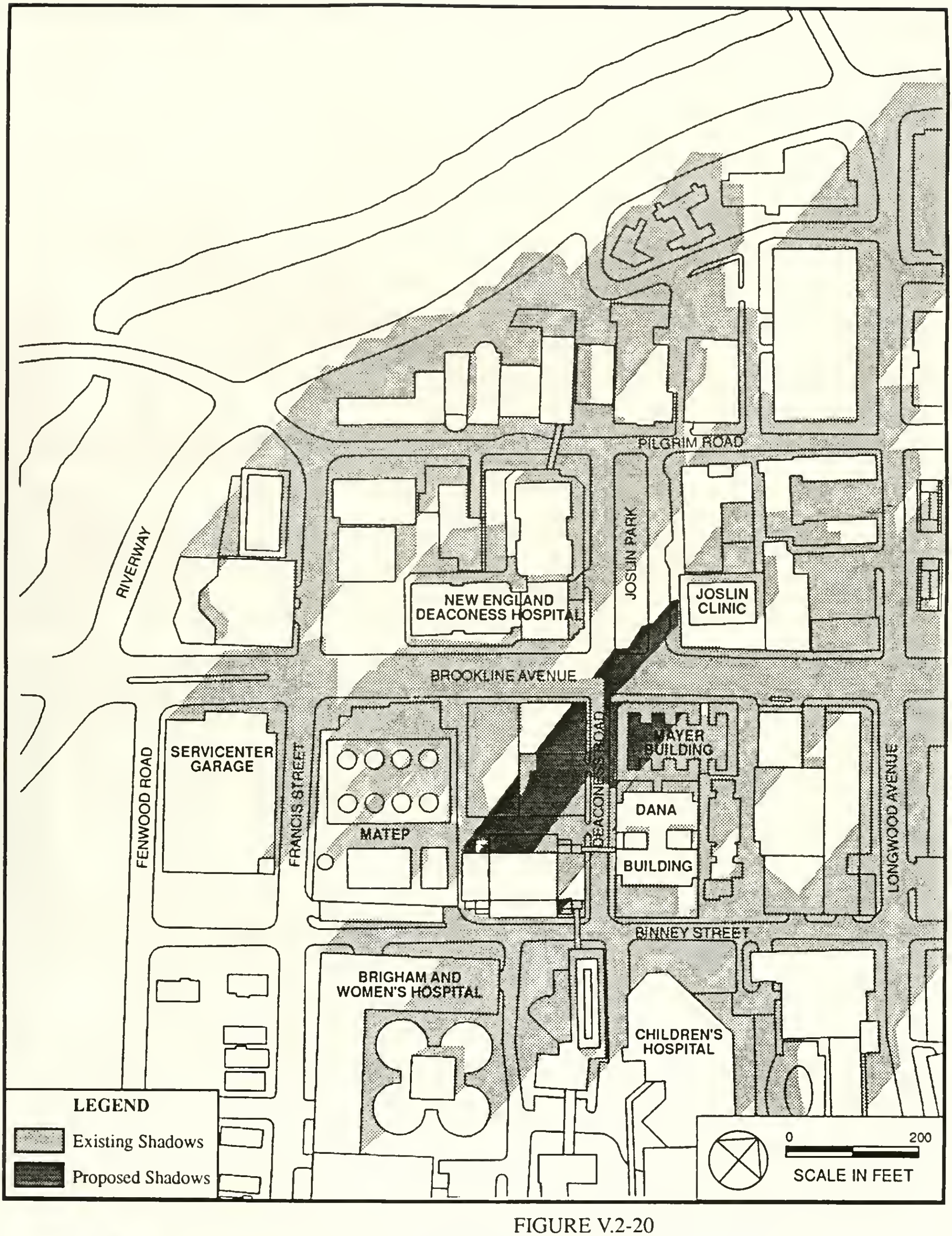

FIGURE V.2-20
DECEMBER 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

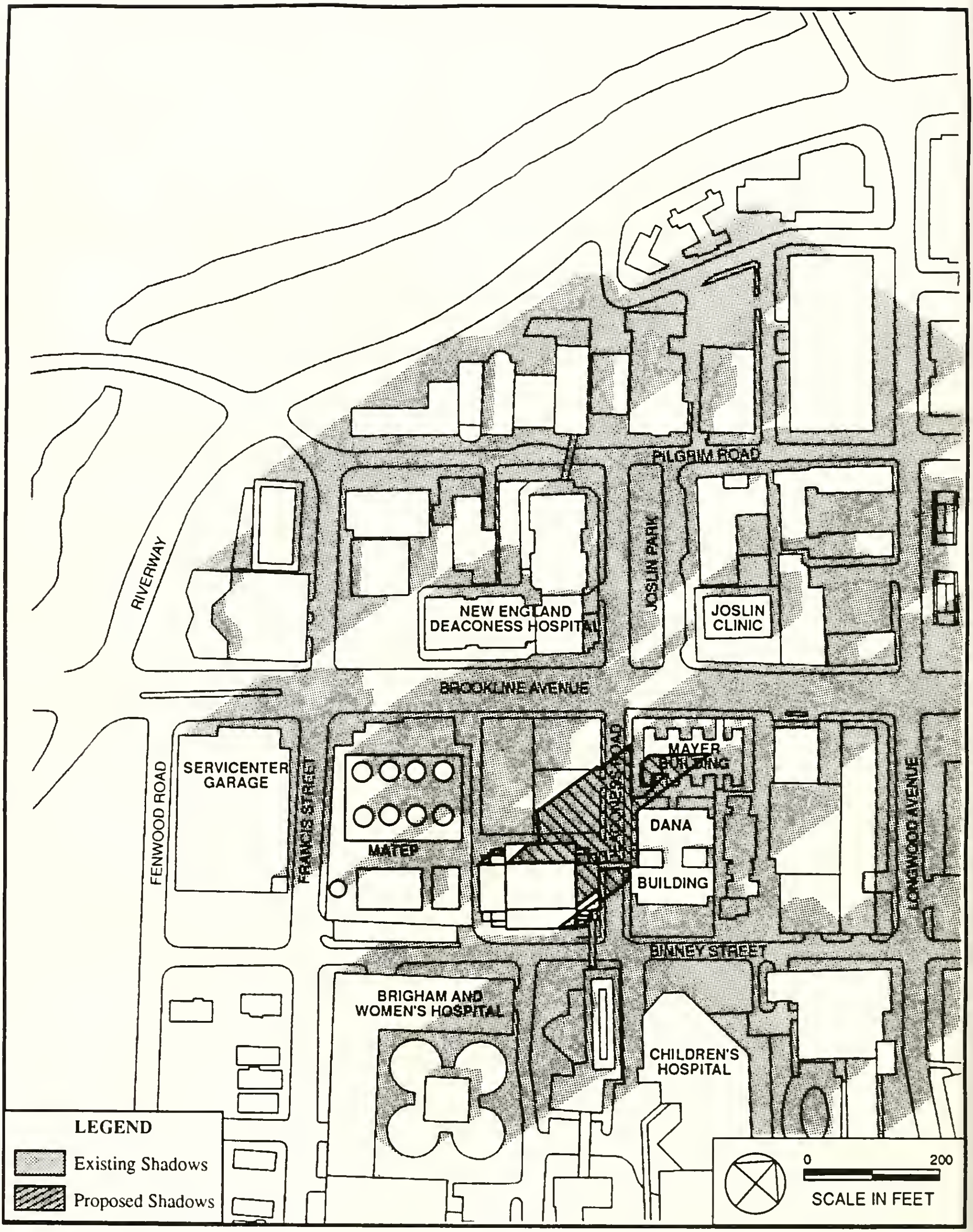

FIGURE V.2-21
DECEMBER 21, 1:00 PM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

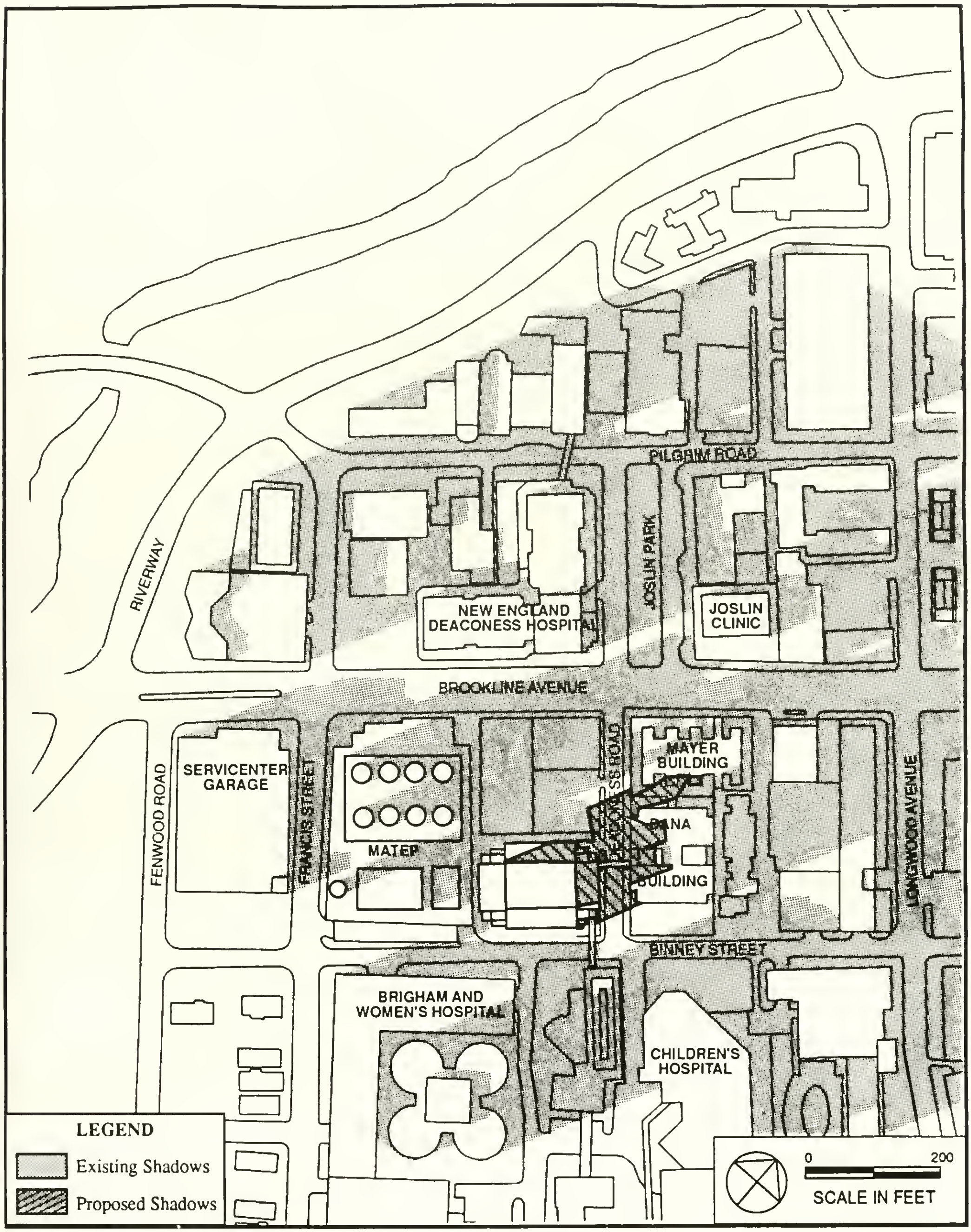

FIGURE V.2-22
DECEMBER 21, 2:00 PM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

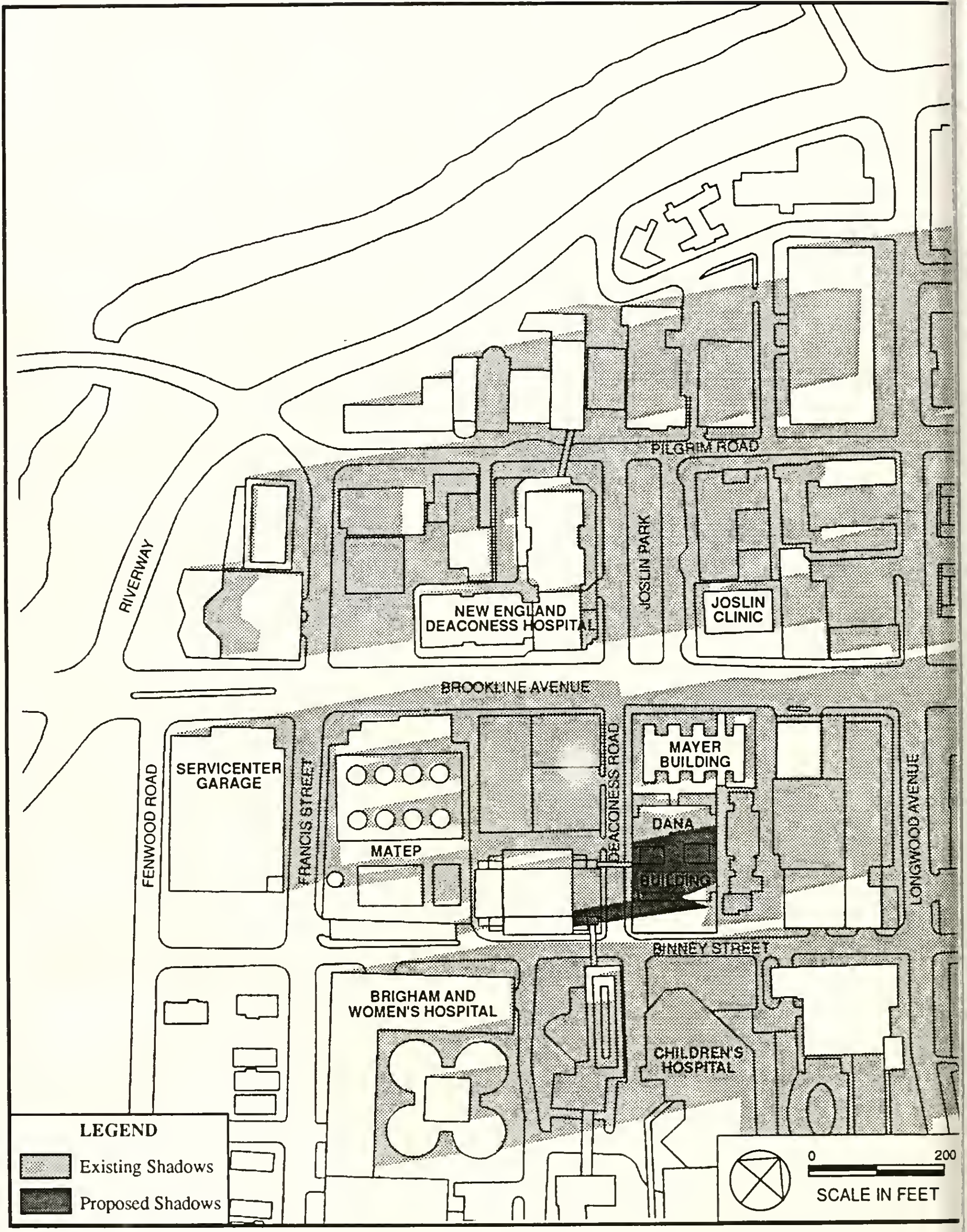

FIGURE V.2-23
DECEMBER 21, 3:00 PM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
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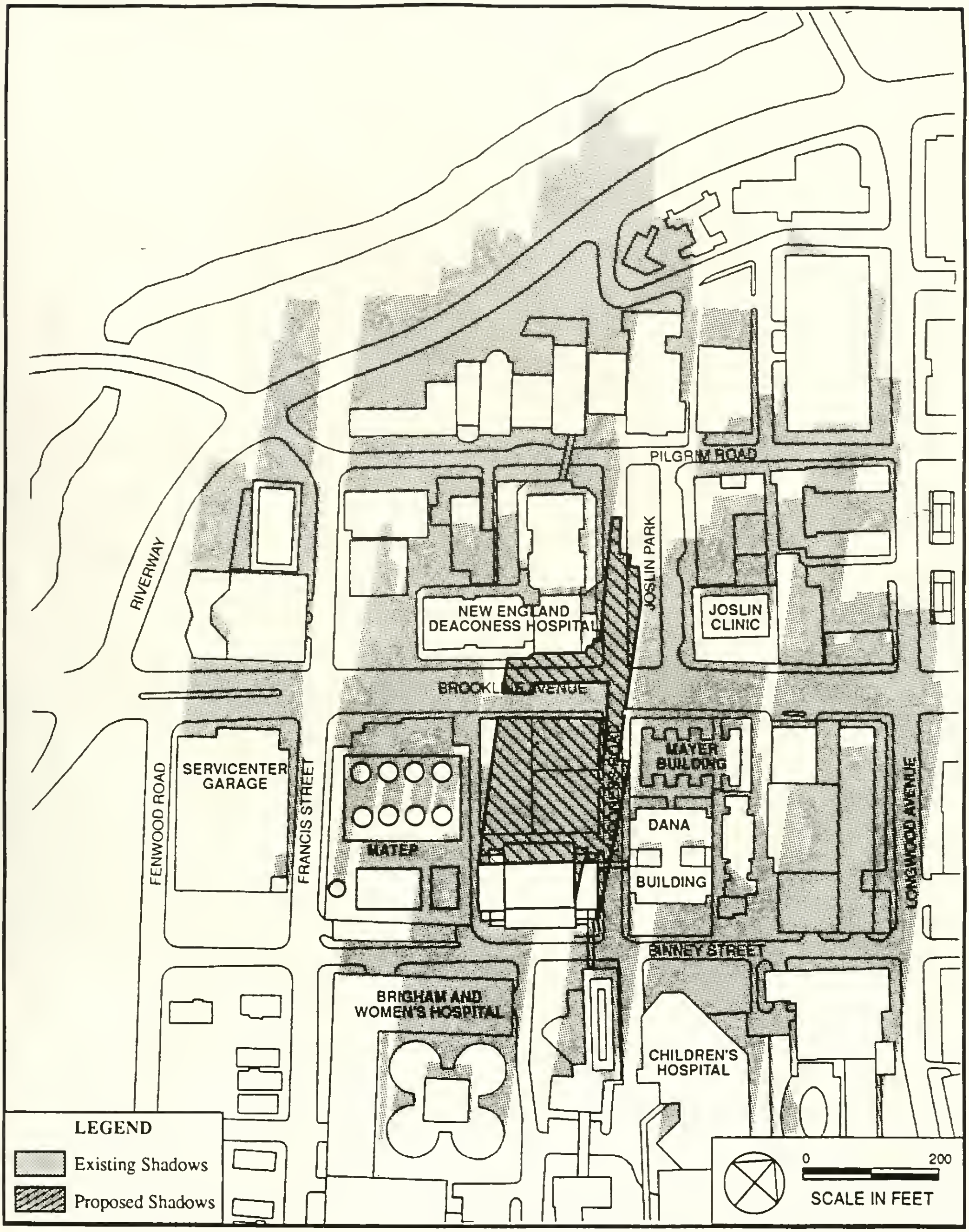

FIGURE V.2-24
JANUARY 21, 10:00 AM SHADOWS
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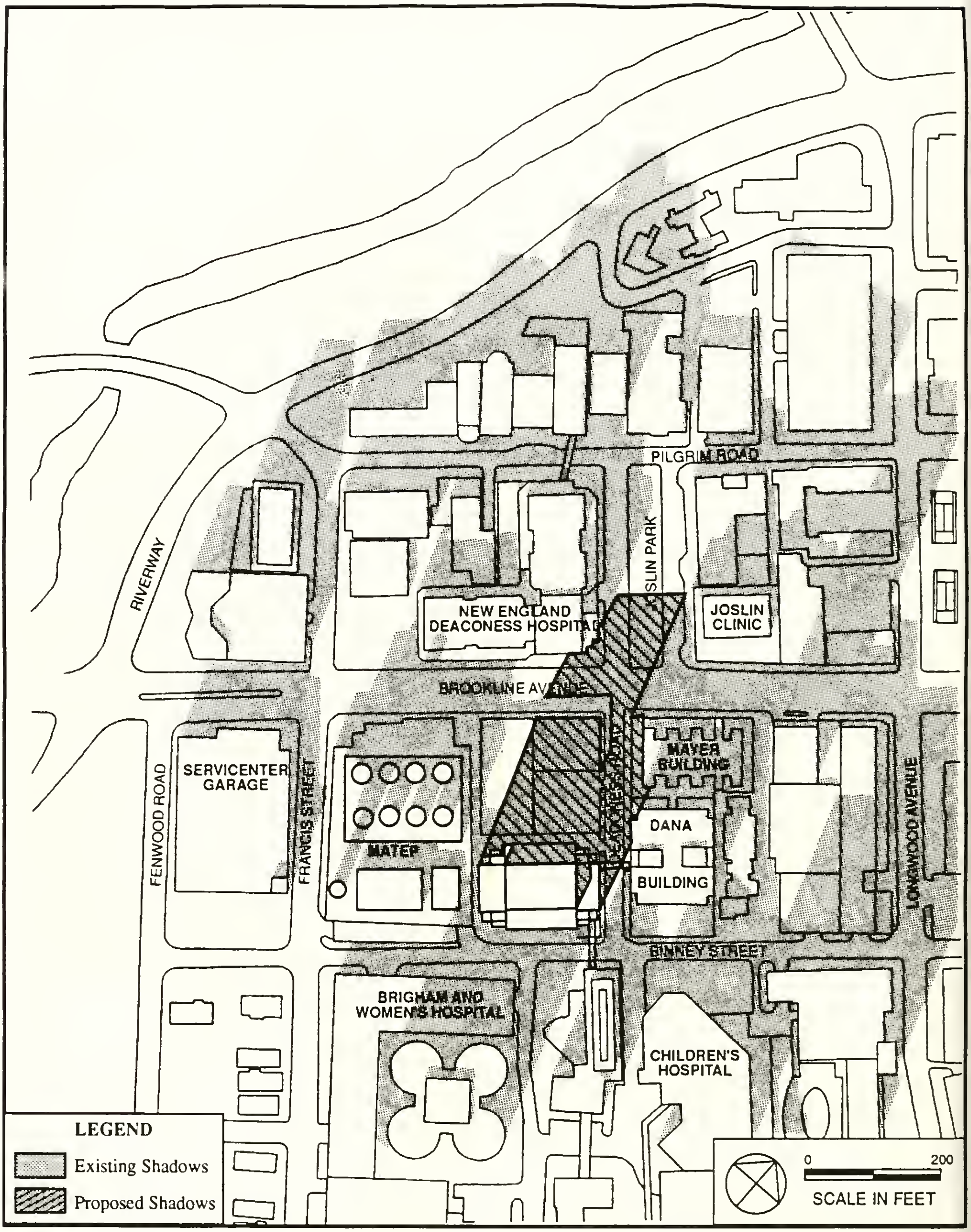

FIGURE V.2-25
JANUARY 21, 11:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

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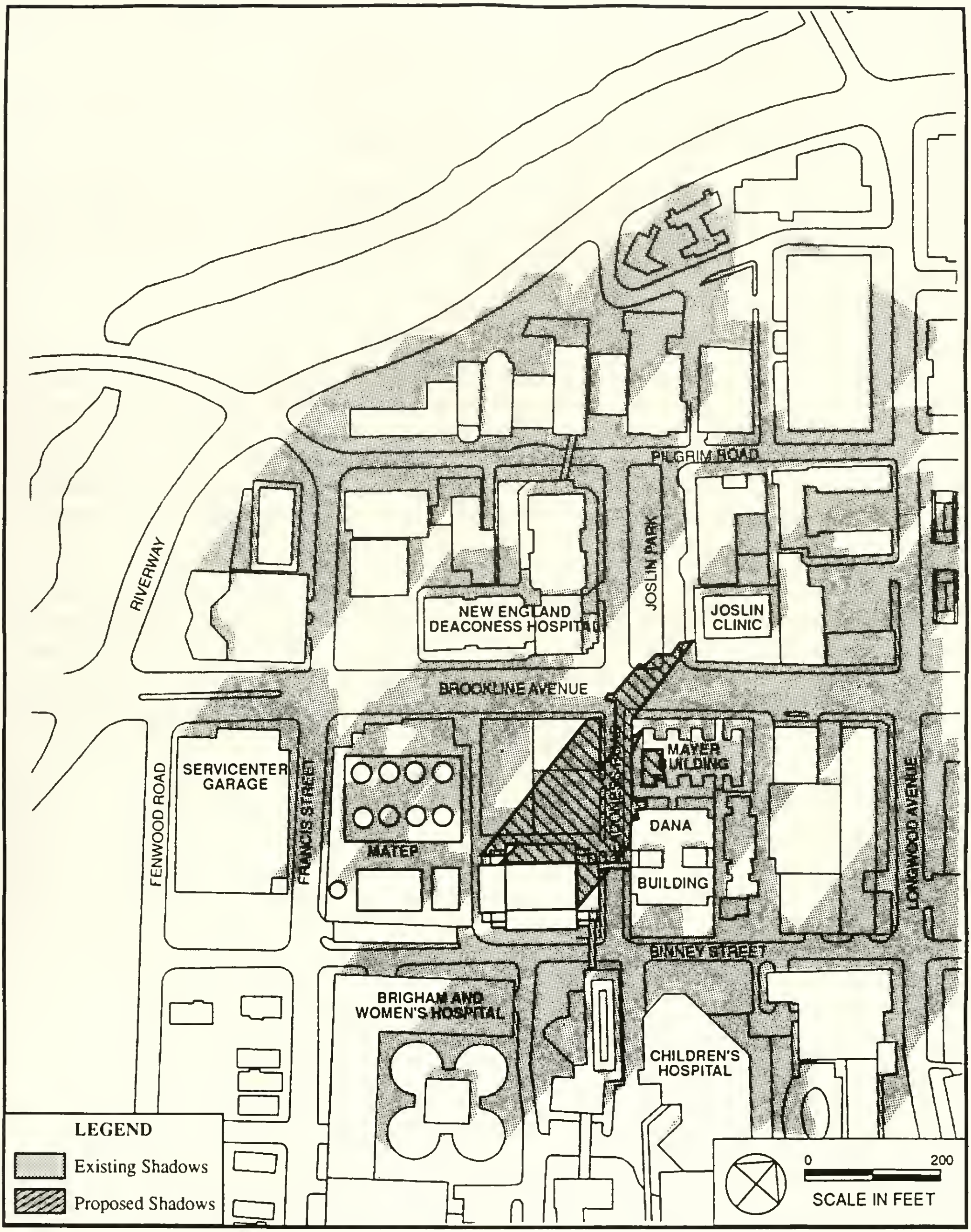

FIGURE V.2-26
JANUARY 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

2.10 February 21 (10:00 AM, 11:00 AM and 12:00 Noon)

Figures V.2-27 through V.2-29 show the extent of shadows during February 21, during the mid- to late-morning hours.

The shadow diagrams show that during the three time periods evaluated, new shadows from the Project are confined to areas immediately adjacent to the site, and Brookline Avenue and Deaconess Road. Joslin Park is no longer affected by the Project.

2.11 Conclusions

The Smith Research Laboratories is comparable in height to many surrounding buildings. This fact, and the presence of other tall buildings nearby, result in few new shadows. In general, new shadows from the Project will be limited primarily to the block itself, and the adjacent Deaconess Road and Brookline Avenue. The on-site plaza on the west side of the building will generally be shaded by the Project, therefore shade tolerant trees will need to be planted at this location.

There are times when a portion of Joslin Park will be affected by new shadows from the Project, however, this will occur only during late fall and the winter months, when the park is not heavily used. Specifically, a portion of the park will receive new shadows between November and January and only for approximately two hours in the late morning. During the spring, summer and fall, when the park is more heavily used, the Project will not affect Joslin Park.

No other off-site sensitive locations are affected by the Project.

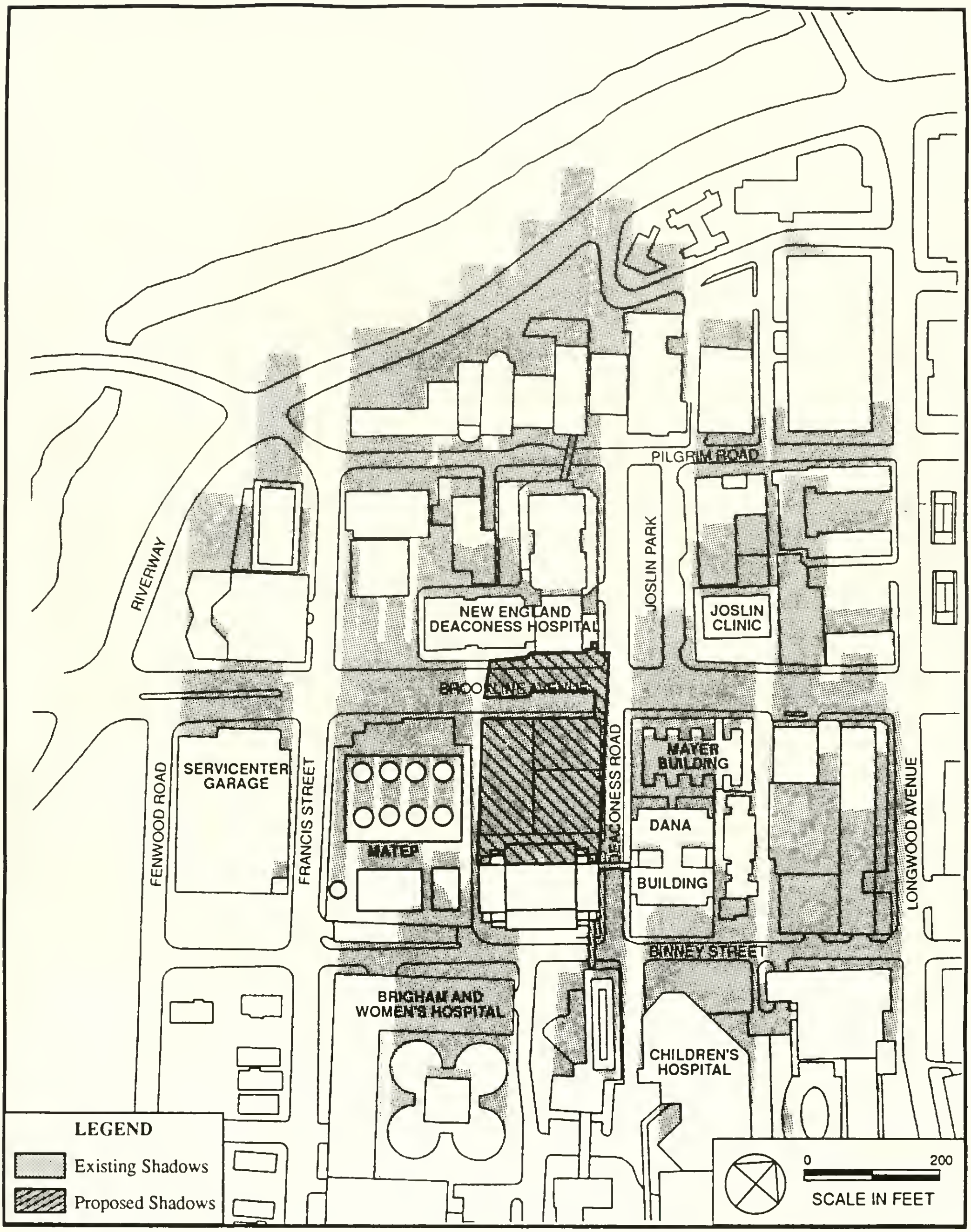

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FIGURE V.2-27
FEBRUARY 21, 10:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

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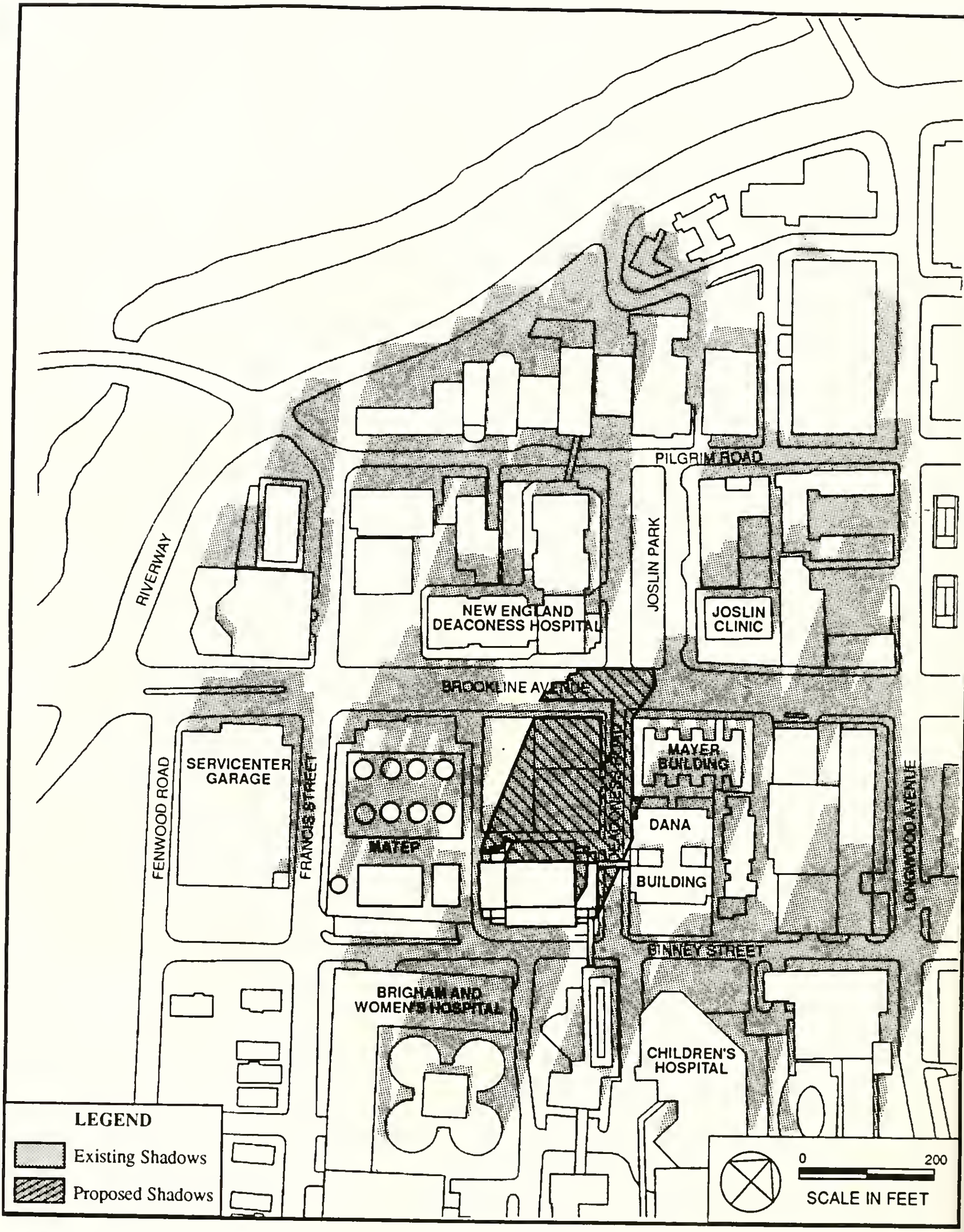

FIGURE V.2-28
FEBRUARY 21, 11:00 AM SHADOWS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

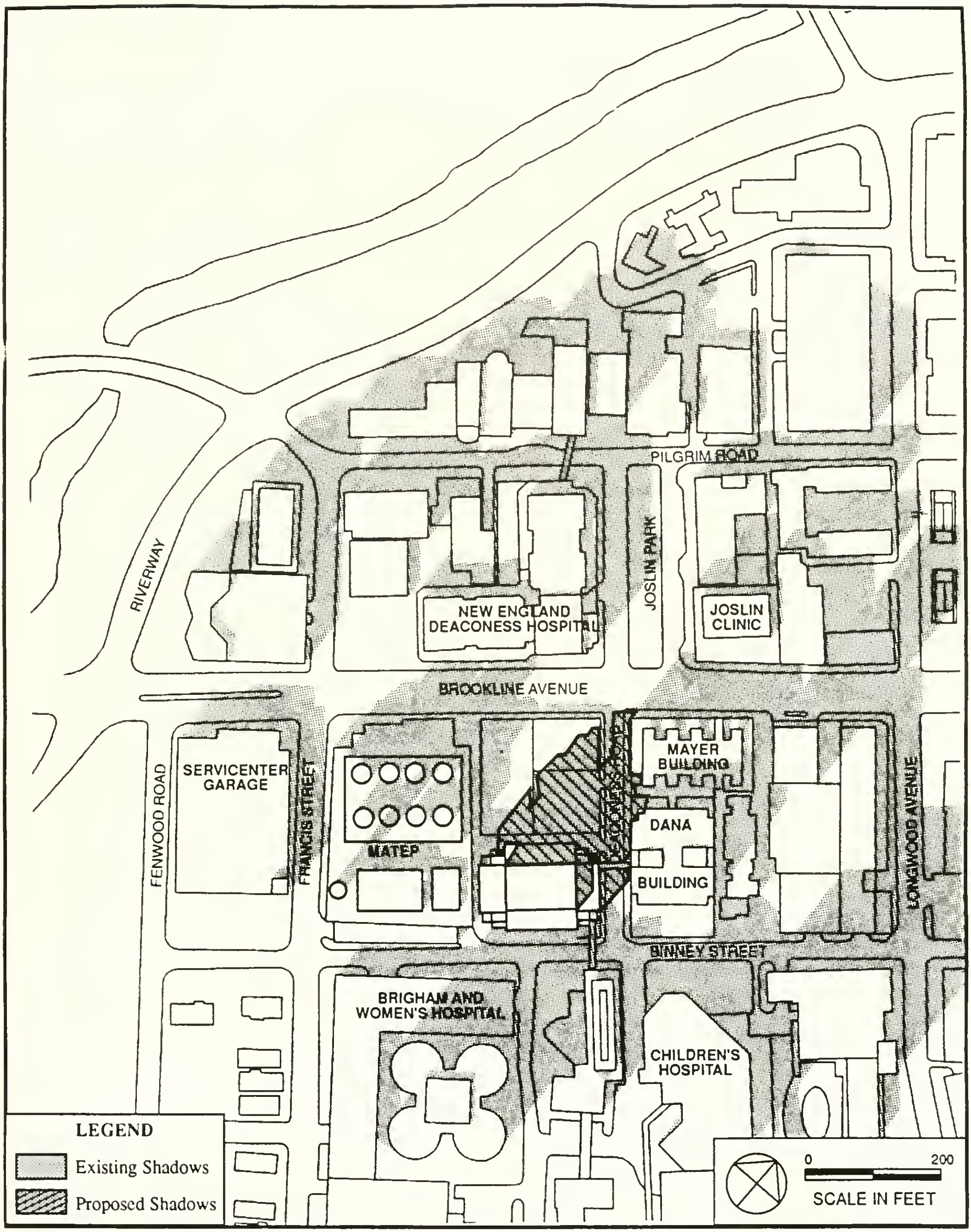

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FIGURE V.2-29
FEBRUARY 21, 12:00 NOON SHADOWS
SMITH RESEARCH LABORATORIES

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3.0 DAYLIGHT ANALYSIS

3.1 Introduction

The BRA requested that the daylight analysis be recalculated based on the reduced project. The revised daylight study contained in this section estimates the changes in daylight obstruction with the design changes made to the Project since the DPIR/DEIR was filed. These changes are as follows:

1) The building has been set back an additional 12 feet from Binney Street;

2) The building has been reduced by one floor, reducing the building height from 194 feet to approximately 184 feet; and

3) The width of the building along Deaconess Road is now 126 feet instead of 120 feet, allowing for the Deaconess Road garage access to be incorporated into the ground floor of the building instead of outside.

3.2 Methodology

The revised daylight study was performed utilizing the BRA Daylighting Analysis (BRADA)* computer program. Using BRADA, a view of the building is taken at ground level from the centerline of the adjacent street. The facade of the building facing the viewpoint including heights, setbacks, corners and other features is plotted onto a base map using lateral and elevation angles. The two-dimensional base map produced by BRADA represents a figure of the building in the "sky dome" from the viewpoint chosen. The percent obstruction of daylight from the viewpoint is calculated by BRADA based on the width of view, the location of the viewpoint, and the building design. Although some additional daylight will be obstructed by the proposed overhead bridge, the BRADA program cannot accurately model a bridge configuration in addition to the building facade and is therefore not included in the analysis.

One viewpoint along Binney Street and two viewpoints along Deaconess Road (one centered on the building and the other representing average conditions along that road segment) were re-evaluated with the Project's new design.**

---

* Harvey Bryan and Susan Stuebing, BRA Daylighting Analysis (BRADA), MIT, Cambridge, MA.

** The DPIR/DEIR presented an analysis of viewpoint locations at Binney Street, Deaconess Road and Brookline Avenue. This was based on the BRA's Scoping Determination. The BRA has since determined that the Brookline Avenue viewpoint does not accurately represent daylight impacts of the Project and, therefore, this viewpoint has been eliminated in the recalculations for the reduced project.

3.3 Results

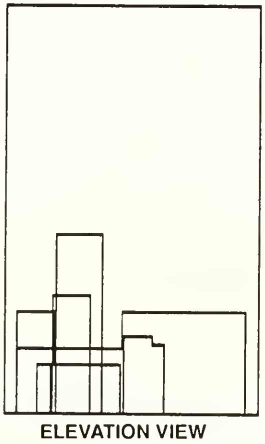
Table V.3-1 presents the results of the daylight study, comparing the new design with the DPIR/DEIR design and with the existing condition. Graphic illustrations of the daylight obstruction (as generated by the BRADA program) from the viewpoints evaluated, are provided in Figures V.3-1 through V.3-6 for existing and future conditions.

Table V.3-1: BRADA Model Predicting Daylight Obstruction

Viewpoint Location	Configuration	Percent Obstruction
1. Binney Street	Existing	6.6
	DPIR/DEIR Design	87.9
	Revised Design	75.3
2. Deaconess Road (primary)	Existing	2.8
	DPIR/DEIR Design	77.2
	Revised Design	78.7
3. Deaconess Road (average)	Existing	2.2
	DPIR/DEIR Design	28.8
	Revised Design	32.9

Since the site is currently mostly undeveloped, existing daylight obstruction is expectedly very small. Daylight obstruction values are 6.6% at the Binney Street viewpoint, 2.8% at the primary Deaconess Road viewpoint and 2.2% at the average Deaconess Road viewpoint.

With the DPIR/DEIR design, daylight obstruction on Binney Street was 87.9%. For the primary viewpoint on Deaconess Road, the DPIR/DEIR presented a somewhat overstated daylight obstruction value (82.4%), as the DPIR/DEIR value was calculated using a 129-foot wide lot, rather than the actual 158-foot wide lot. The corrected daylight obstruction at the primary viewpoint on Deaconess Road results in a 77.2% obstruction value. Daylight obstruction is 28.8% at the average Deaconess Road viewpoint.



Boston
Redevelopment
Authority
Daylighting
Analysis

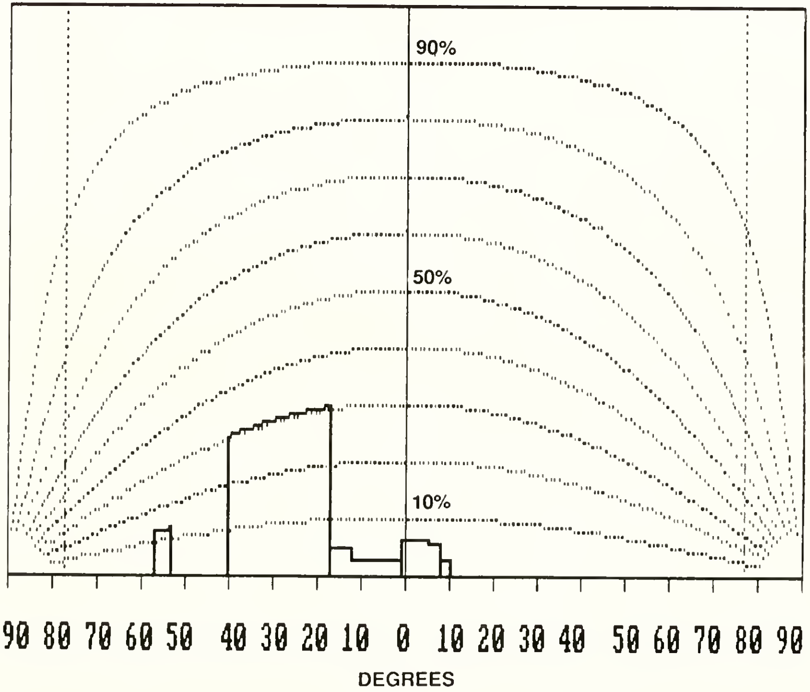


FIGURE V.3-1
VIEW FROM BINNEY STREET
EXISTING CONDITIONS
SMITH RESEARCH LABORATORIES

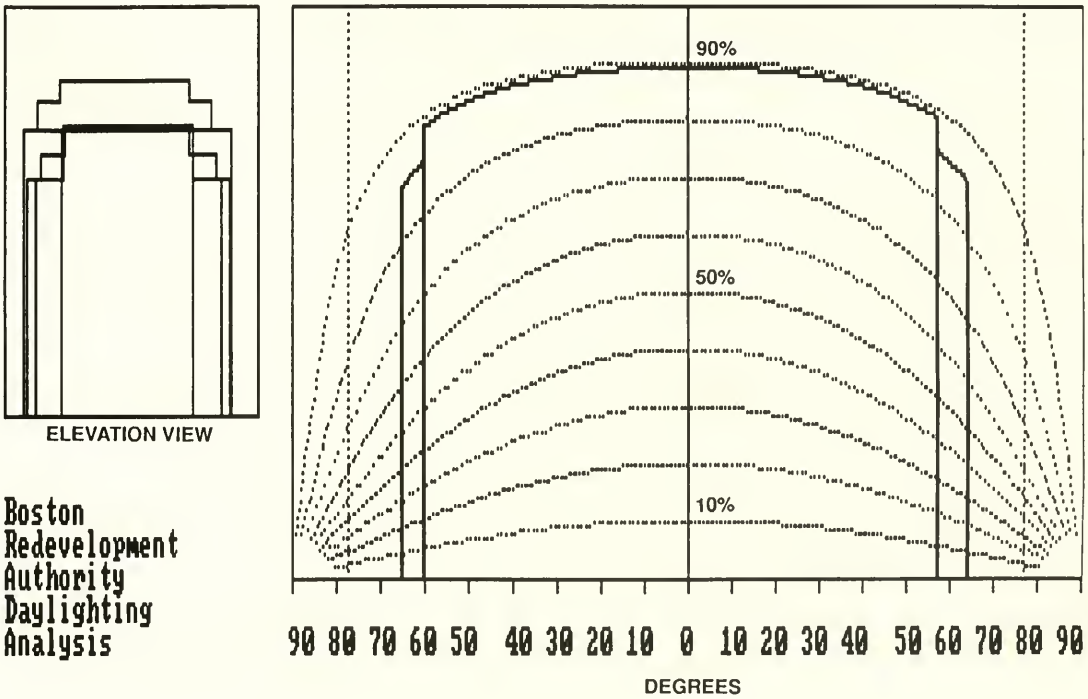


FIGURE V.3-2
VIEW FROM BINNEY STREET
PROPOSED CONDITIONS
SMITH RESEARCH LABORATORIES

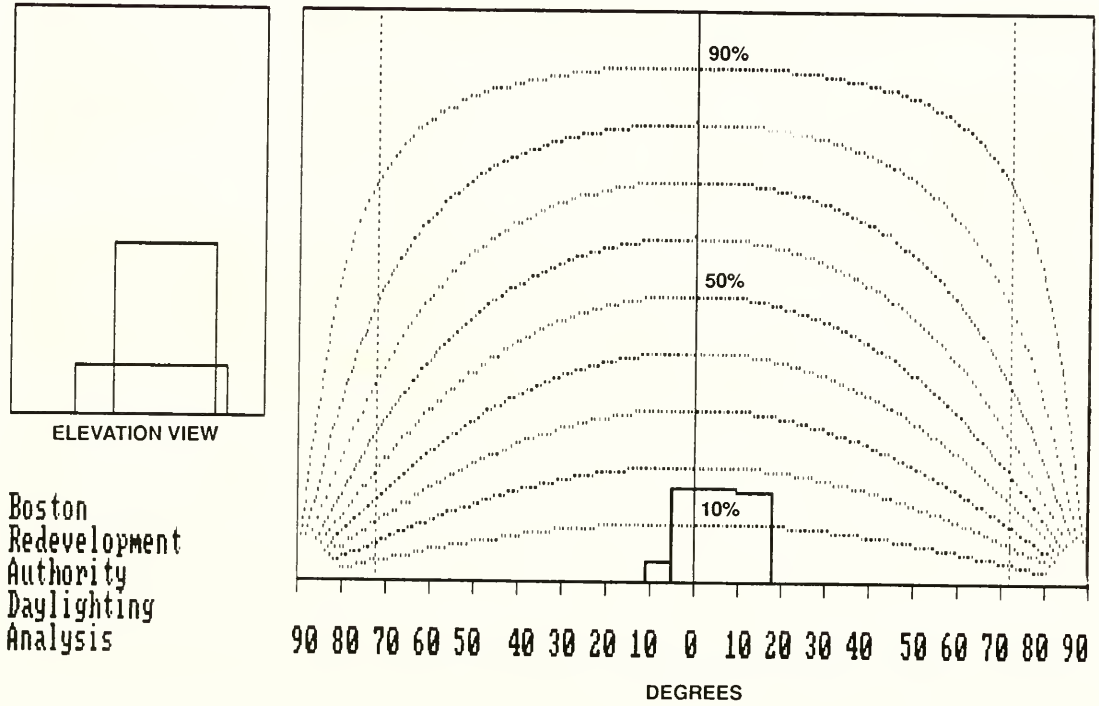
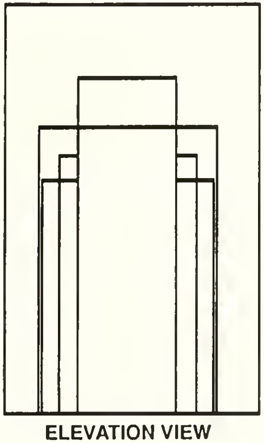


FIGURE V.3-3
VIEW FROM DEACONESS ROAD (PRIMARY VIEW)
EXISTING CONDITIONS
SMITH RESEARCH LABORATORIES



Boston
Redevelopment
Authority
Daylighting
Analysis

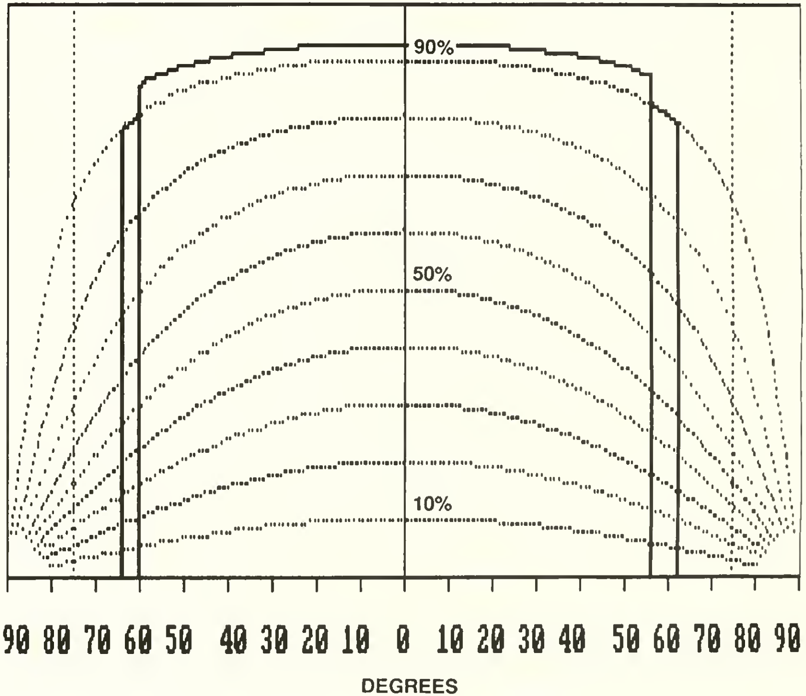


FIGURE V.3-4
VIEW FROM DEACONESS ROAD (PRIMARY VIEW)
PROPOSED CONDITIONS
SMITH RESEARCH LABORATORIES

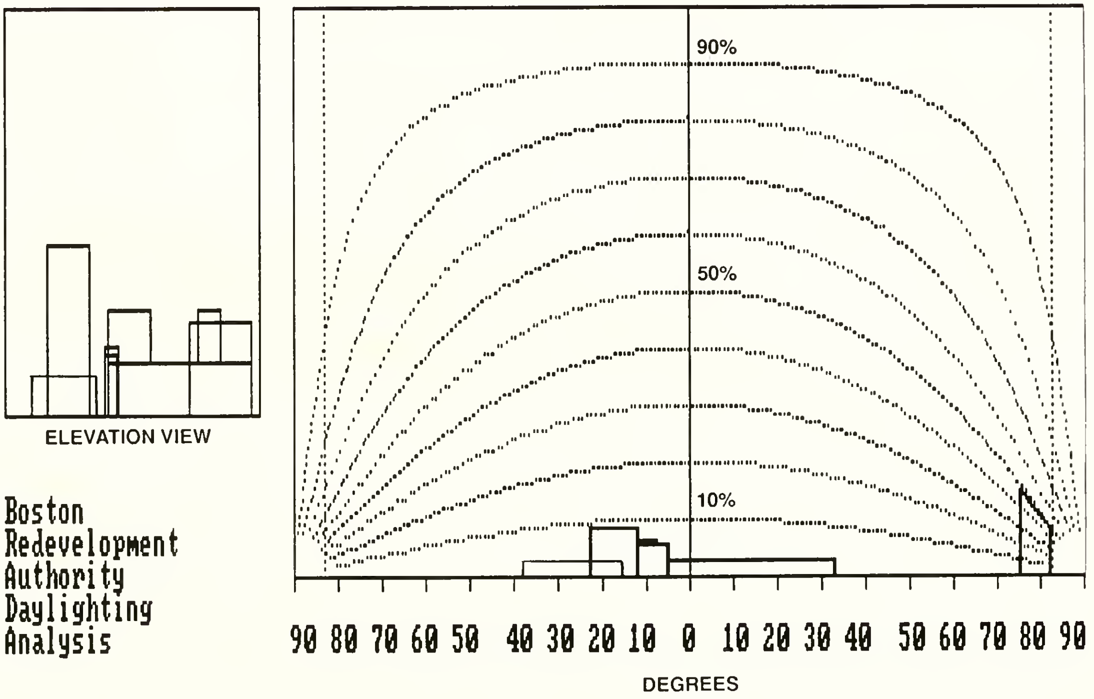


FIGURE V.3-5
VIEW FROM DEACONESS ROAD (AVERAGE VIEW)
EXISTING CONDITIONS
SMITH RESEARCH LABORATORIES

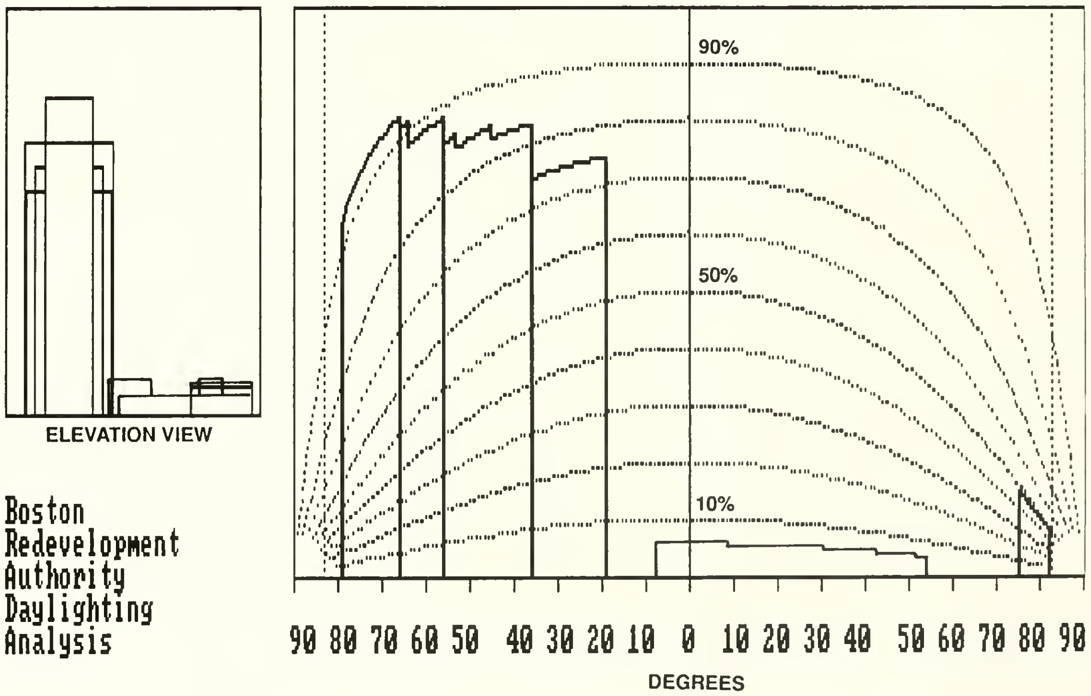


FIGURE V.3-6
VIEW FROM DEACONESS ROAD (AVERAGE VIEW)
PROPOSED CONDITIONS
SMITH RESEARCH LABORATORIES

Since Binney Street is a major pedestrian route, the revised design reflects efforts at reducing the daylight obstruction values from that viewpoint. The additional setback from Binney Street and the reduced height of the proposed building will mitigate the amount of daylight obstruction along Binney Street, which will be most affected by the new building. The results of the analysis show that the revised design will reduce the daylight obstruction value along Binney Street from that measured in the DPIR/DEIR by 12.6%, resulting in a new value of 75.3%.

Along Deaconess Road, daylight obstruction will be slightly increased to 78.7% for the primary viewpoint, and to 32.9% for the average viewpoint. These minor increases are due to the widening of the building in the revised design. In order to incorporate the garage access into the ground floor of the building instead of outside, the width of the building mass along Deaconess Road was increased by six feet.

3.4 Conclusions

The daylight analysis was conducted to estimate the effect of the Smith Research Laboratories on the amount of daylight reaching adjacent streets. The results do indicate an increase in the amount of daylight obstructed with construction of the Smith Research Laboratories. However, this increase is not unusual and is anticipated when building on a partially vacant lot. Design changes incorporated since the DPIR/DEIR have reduced the amount of daylight obstruction from the Binney Street viewpoint; however, further reductions in daylight obstruction can only be accomplished by a drastically reduced building, as was discussed in the DPIR/DEIR zoning configuration analysis. The daylight obstruction values for the zoning configuration, which included a 95-foot building, were 74.1% along Binney Street, and 63.4% and 13.5% along the primary and average Deaconess Road viewpoints, respectively. The Binney Street value is not significantly lower than the value for the revised design. As presented in the DPIR/DEIR, the revised design is comparable to other LMA buildings in terms of daylight obstruction.

The enclosed pedestrian bridge over Deaconess Road will result in some additional daylight impact. This impact, however, is mitigated by installing the bridge as high as practicable (third level) and by use of materials designed to give a light and transparent appearance. The replacement bridge over Binney Street will actually lead to reductions in daylight obstruction when compared to the existing bridge over the corner of Deaconess Road and Binney Street. By replacing it with a bridge that is higher (third floor instead of second floor) and by using materials that will give it a more transparent appearance, there will be daylight improvement at that location.

4.0 AIR QUALITY

An analysis was conducted for the DPIR/DEIR to evaluate potential air quality impacts of the proposed Smith Research Laboratories. This analysis considered mobile source emissions associated with the Project, emissions from the proposed below-grade garage and laboratory vents, emissions from the MATEP stack on building intakes and the aerodynamic effects of the proposed building on the MATEP stack. The analysis results showed that no exceedances of the standards will occur with construction of the Smith Research Laboratories.

The BRA's PAD requested that the following issues be addressed in the FPIR/FEIR:

1) Figures and tables presented should have consistent identification.

2) Boston Fire Department label on one of the intersection figures should be identified.

3) Actual height of the MATEP stack should be given and an explanation on whether it conforms to the GEP stack height.

4) A summary of MATEP air quality data should be included.

The figures and tables presented in DPIR/DEIR as part of the microscale analysis have been reprinted in the following sections with appropriate labels. Other information requested in PAD is also included.

4.1 Microscale Analysis Locations and Model Results

The figures showing the receptor locations studied in the microscale analysis are included in Figures V.4-1 through V.4-6. Tables V.4-1 and V.4-2 present the results for the intersection analysis and the parking garage analysis, respectively. Consistent identification has been used in the figures and tables for clarity. In addition, the Boston Fire Department receptor in Figure V.4-1 has been corrected to read Boston Five ATM.

The microscale analysis results shown in Tables V.4-1 and V.4-2 show that the NAAQS will be met at all sensitive locations evaluated.

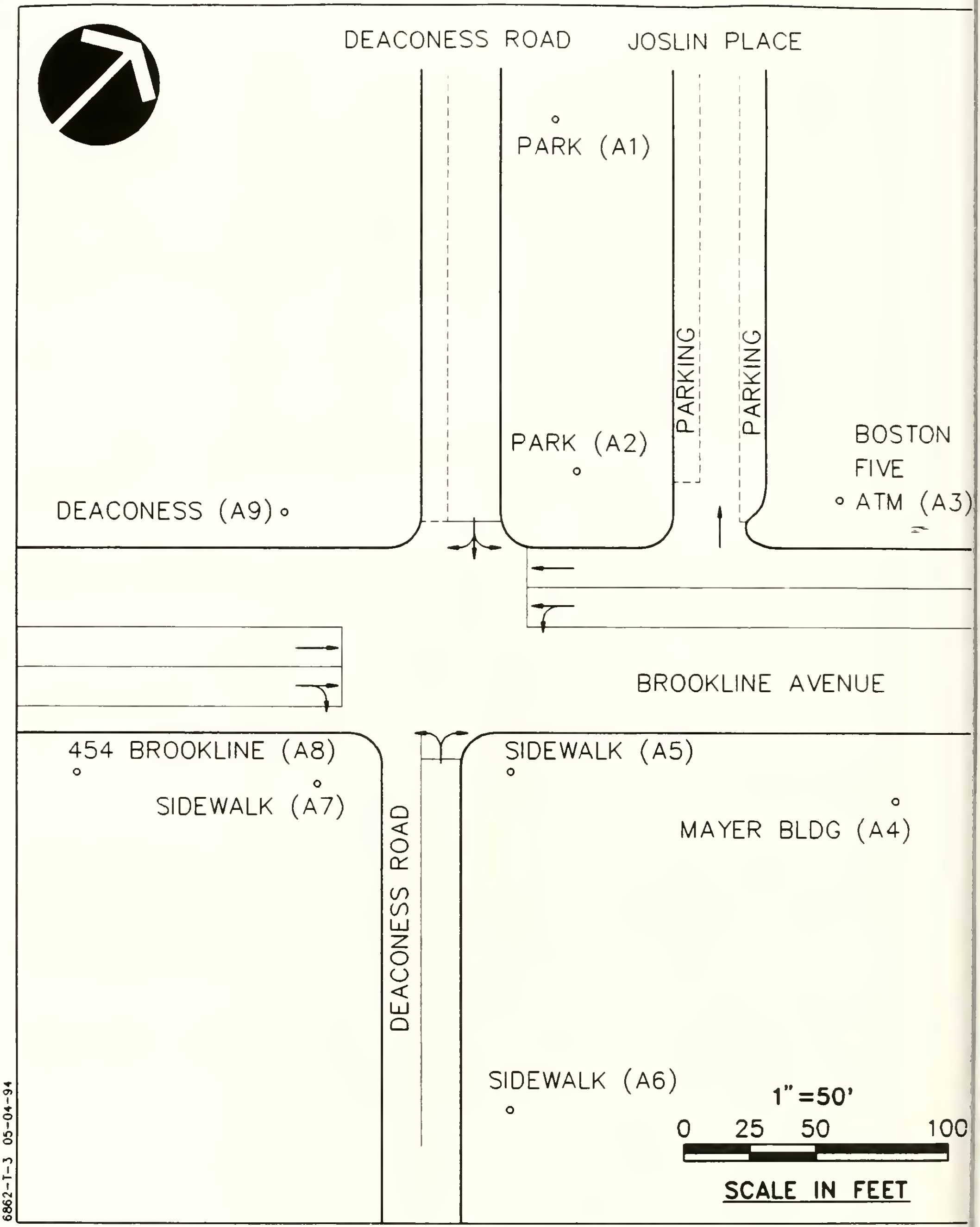


FIGURE V.4-1
BROOKLINE AVENUE/DEACONESS ROAD INTERSECTION
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

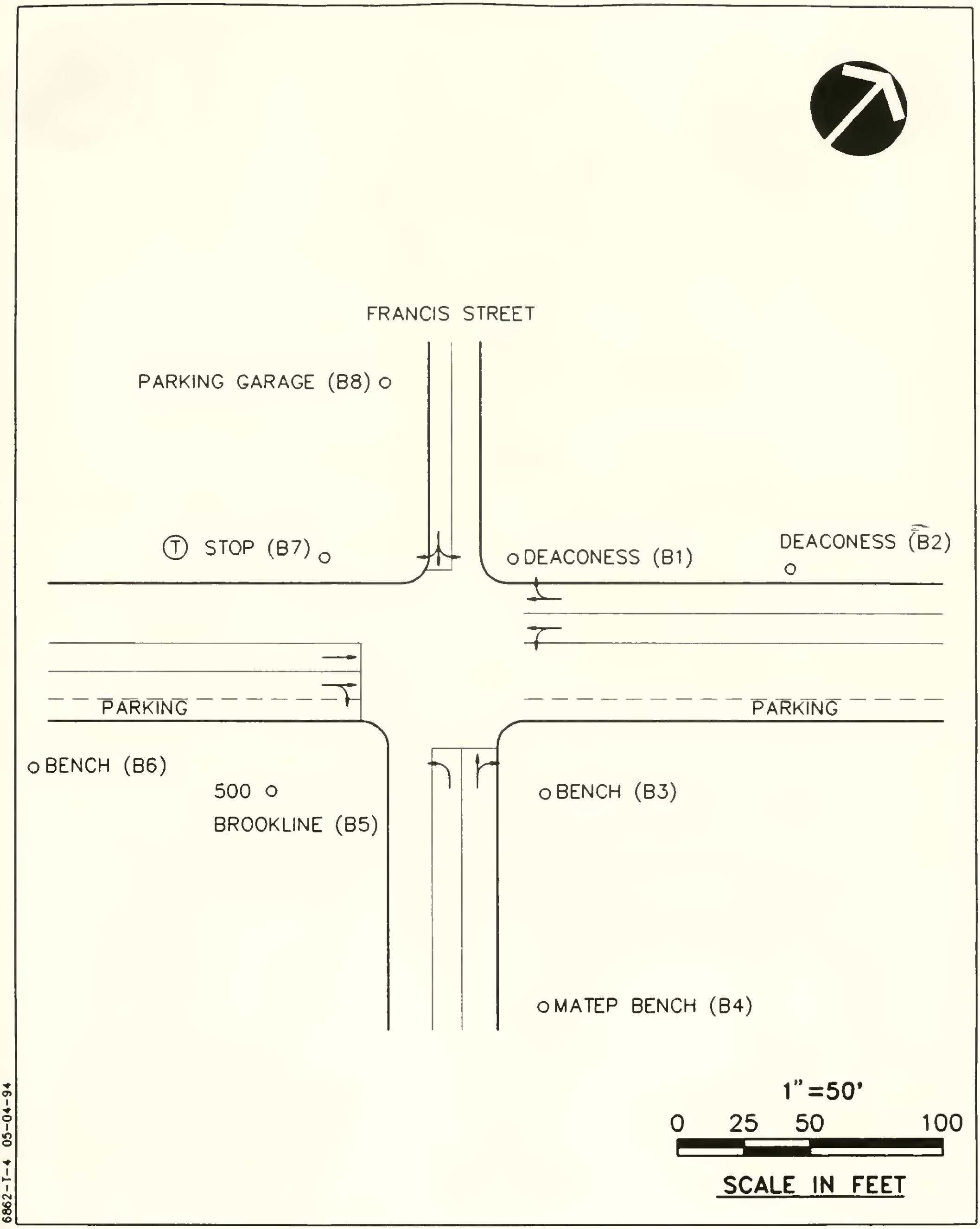


FIGURE V.4-2
BROOKLINE AVENUE/FRANCIS STREET INTERSECTION
SMITH RESEARCH LABORATORIES

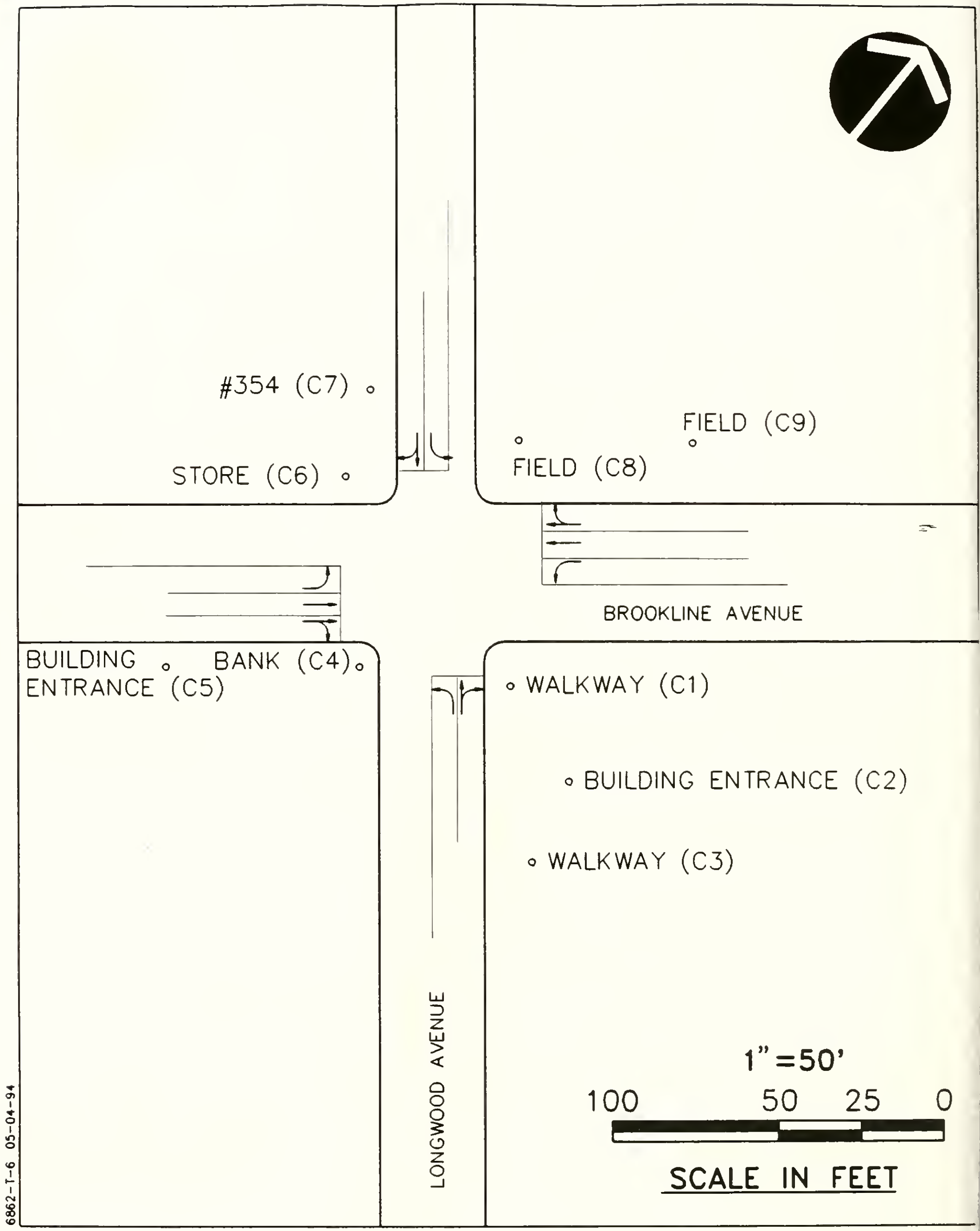


FIGURE V.4-3
BROOKLINE AVENUE/LONGWOOD AVENUE INTERSECTION (EXISTING
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

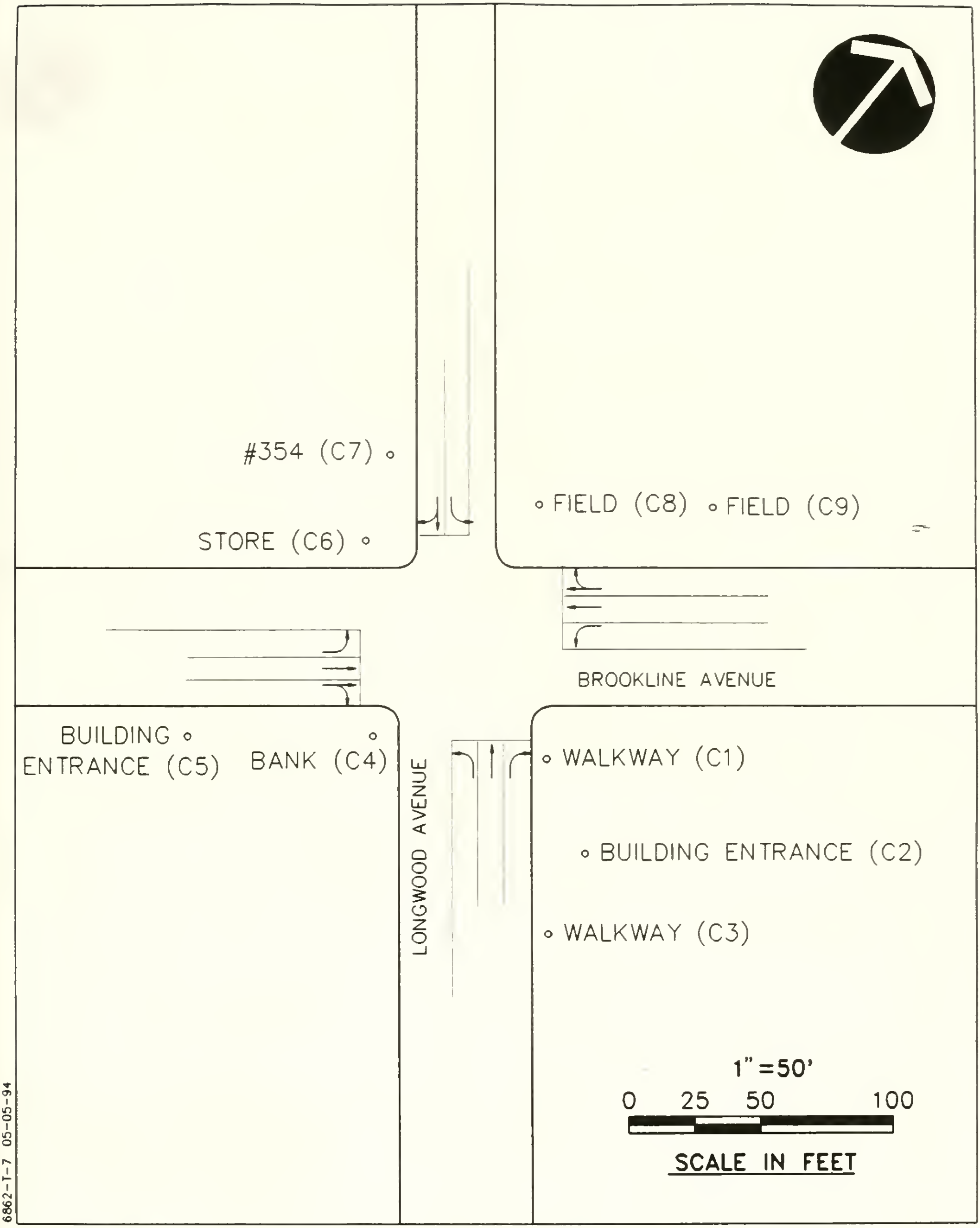


FIGURE V.4-4
BROOKLINE AVENUE/LONGWOOD AVENUE INTERSECTION (PROPOSED)
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

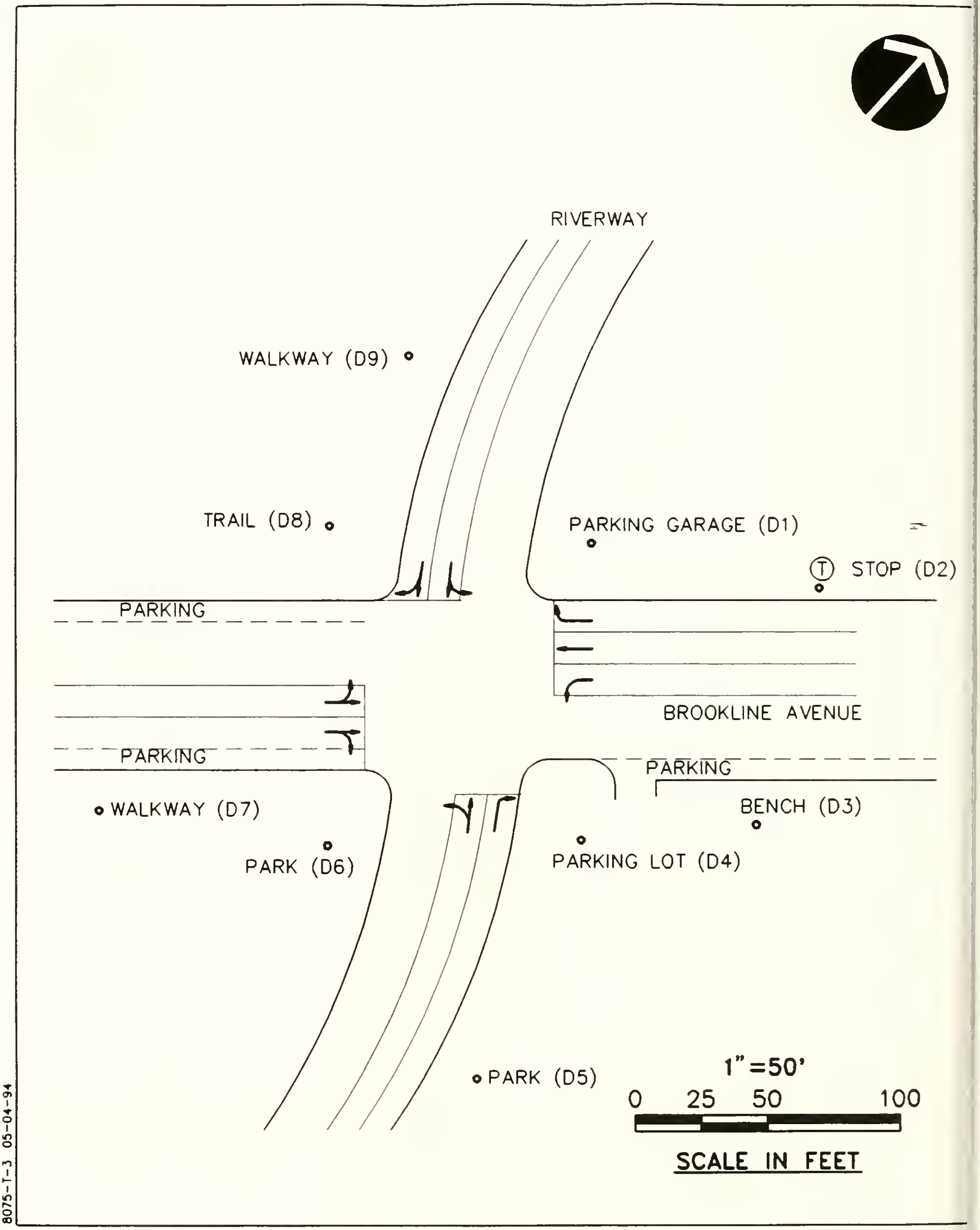


FIGURE V.4-5
BROOKLINE AVENUE/RIVERWAY INTERSECTION
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

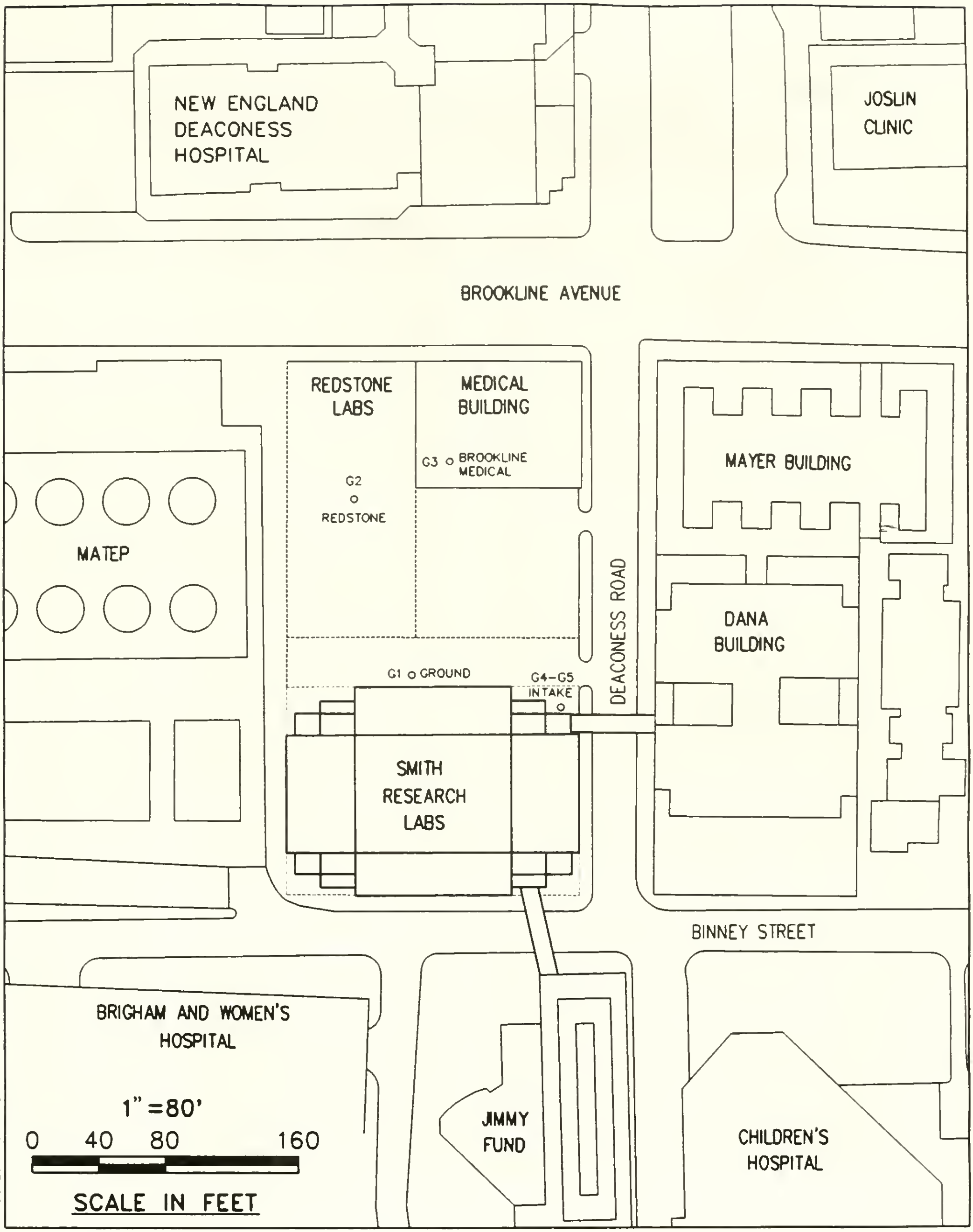


FIGURE V.4-6
PARKING GARAGE RECEPTOR LOCATIONS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

Table V.4-1: Microscale Analysis
Maximum Predicted Ambient CO Concentrations (ppm) from Intersections, On-Site Parking and Background

Intersection	Receptor	Existing 1-Hr	Existing 8-Hr	Future No-Build 1-Hr	Future No-Build 8-Hr	Future Build 1-Hr	Future Build 8-Hr
Brookline Avenue/ Deaconess Road	A1	7.0	4.4	5.6	3.5	5.9	3.7
	A2	9.9	6.4	7.9	5.1	8.4	5.4
	A3	9.3	6.0	7.7	5.0	7.4	4.7
	A4	8.1	5.2	6.7	4.3	6.8	4.3
	A5	10.0	6.5	8.2	5.3	8.2	5.3
	A6	7.2	4.5	5.6	3.5	6.2	3.9
	A7	8.8	5.7	7.3	4.7	7.4	4.8
	A8	9.7	6.3	7.8	5.0	7.4	4.8
	A9	9.4	6.1	7.8	5.0	7.9	5.1
Brookline Avenue/ Francis Street	B1	9.9	6.4	8.3	5.4	8.5	5.5
	B2	8.3	5.3	6.9	4.4	7.1	4.5
	B3	11.3	7.4	9.2	6.0	9.5	6.2
	B4	9.7	6.3	7.9	5.1	8.1	5.2
	B5	8.8	5.7	7.3	4.7	7.6	4.9
	B6	8.2	5.2	7.0	4.5	7.3	4.6
	B7	9.2	5.9	7.6	4.9	8.0	5.1
	B8	8.3	5.3	6.8	4.3	7.0	4.4
Brookline Avenue/ Longwood Avenue	C1	12.6	8.3	10.8	7.1	11.0	7.3
	C2	8.6	5.5	7.7	5.0	7.8	5.1
	C3	8.8	5.7	7.3	4.7	7.3	4.7
	C4	12.2	8.0	10.4	6.9	10.5	7.0
	C5	12.6	8.3	10.7	7.1	10.8	7.2
	C6	10.7	7.0	8.8	5.7	9.0	5.9
	C7	14.4	9.6	9.4	6.2	9.6	6.3
	C8	10.1	6.6	8.4	5.5	8.6	5.6
	C9	10.6	6.9	9.1	5.9	9.2	6.0
Brookline Avenue/Riverway	D1	10.9	7.1	8.7	5.7	8.9	5.8
	D2	11.5	7.6	9.7	6.4	9.9	6.5
	D3	10.0	6.5	8.2	5.3	8.3	5.4
	D4	11.0	7.2	8.6	5.6	9.0	5.9
	D5	11.7	7.7	8.7	5.7	8.8	5.8
	D6	10.2	6.6	8.3	5.4	8.7	5.7
	D7	11.5	7.6	8.8	5.7	8.9	5.8
	D8	10.8	7.1	8.6	5.6	8.9	5.8
	D9	10.7	7.0	7.8	5.0	7.9	5.1
NAAQS		**35.0**	**9.0**	**35.0**	**9.0**	**35.0**	**9.0**

Table V.4-2: Parking Garage Receptors

Location	Concentration (ppm) 1-Hour	8-Hour
G1 - Pedestrian Level Below Vent	4.3	2.6
G2 - Redstone Building Air Intake	4.2	2.5
G3 - Brookline Medical Air Intake	4.2	2.5
G4 - Project's 4th Floor Air Intake	4.3	2.5
G5 - Project's 14th Floor Air Intake	4.2	2.5
NAAQS	**35.0**	**9.0**

4.2 MATEP Air Quality Data

4.2.1 Stack Height

The MATEP stack height is 315 feet (96 meters) above its base elevation. The 1988 modeling study referenced in Section V.4.3 of the DPIR/DEIR used this height. Because this height is less than the calculated "formula" GEP height, the 1988 modeling study accounted for potential aerodynamic building downwash effects (as required by EPA and DEP modeling guidance) in the analysis. The dimensions and downwash influence of the controlling building (i.e. the Brigham and Women's Hospital Bed Tower) were conservatively modeled for every wind direction. The Bed Tower will remain the controlling structure after construction of the Smith Research Laboratories.

4.2.2 Air Quality Monitoring Data Summary

Within the "near field", MATEP maintains two roof level monitors: (1) at Children's Hospital and (2) at the Deaconess Hospital's 110 Francis Street Parking Garage. As part of the final decision on the MATEP Air Plans Application, these sites were required to monitor hourly NO_2 concentrations and document actual "near-field" NO_2 concentrations for MATEP facility operation. Table V.4-3 summarizes actual monitoring results since MATEP's diesels went into full operation. The results demonstrate that ambient concentrations are well below Massachusetts standards.

Table V.4-3: NO_2 Monitoring Results at Deaconess Hospital and Children's Hospital Sites

	Concentrations (ug/m^3)			
	Deaconess Hospital 110 Francis Street Garage		Children's Hospital	
Year	**1-Hr Max**	**Annual Mean**	**1-Hr Max**	**Annual Mean**
1993	159	42	183	44
1992	203	46	198	46
1991	149	44	170	46
1990	196	46	240	48
1989	238	50	249	45
1988	176	50	185	49
1987	191	51	197	47
1986	188	49	193	46
1985	204	50	184	46
Standard	**320**	**100**	**320**	**100**

5.0 NOISE

A noise impact analysis was conducted for the Project and presented in the DPIR/DEIR. Major noise sources expected at the Smith Research Laboratories were identified and quantified at nearby sensitive receptors. The results of the study indicated that the City of Boston noise standards can be met with common noise control measures.

The BRA's PAD suggested that the receptor identifications in the tables should be keyed to the numbers on DPIR/DEIR Figure V.7-2. The PAD also stated that the height of the receptors should be provided (ground level, elevated, etc.). This information is provided or clarified in the following sections.

5.1 Receptor Identification

Figure V.5-1 shows the sensitive receptor locations modeled for the noise analysis. These locations were chosen to conservatively evaluate potential noise impacts of the Project's operation on the surrounding area.

To maintain a conservative impact evaluation, noise level estimates were made at each receptor location based on the noise source-receptor combination that produced the highest noise level at that location.

Calculations were made to determine the elevation of the receiving receptor where the Project noise levels would be highest, regardless of the actual elevation of the receptor. In other words, the receptor was assumed to be potentially located anywhere from ground level to the highest elevation of the Smith Research Laboratories mechanicals. For example, the Dana Building patient beds on Deaconess Road are actually located on the 8th, 9th, and 11th floors, however, the elevation which produced the worst-case noise level along the edge of the building was used for the analysis. Likewise, the Brigham and Women's Bed Tower has patient beds on several floors (and therefore varying elevations). Therefore, in order to evaluate a worst-case scenario, the elevation of the receiving receptor was assumed to be at the same horizontal plane (same elevation) as the worst noise source levels. In general, the highest noise level estimates were produced at the upper levels of the receiving buildings. For example, noise from the cooling tower was calculated at the receptors using the same elevation as the cooling tower. Since residential receptors evaluated are in fact lower than the cooling towers, the actual cooling tower noise levels should be less than predicted in the noise study.

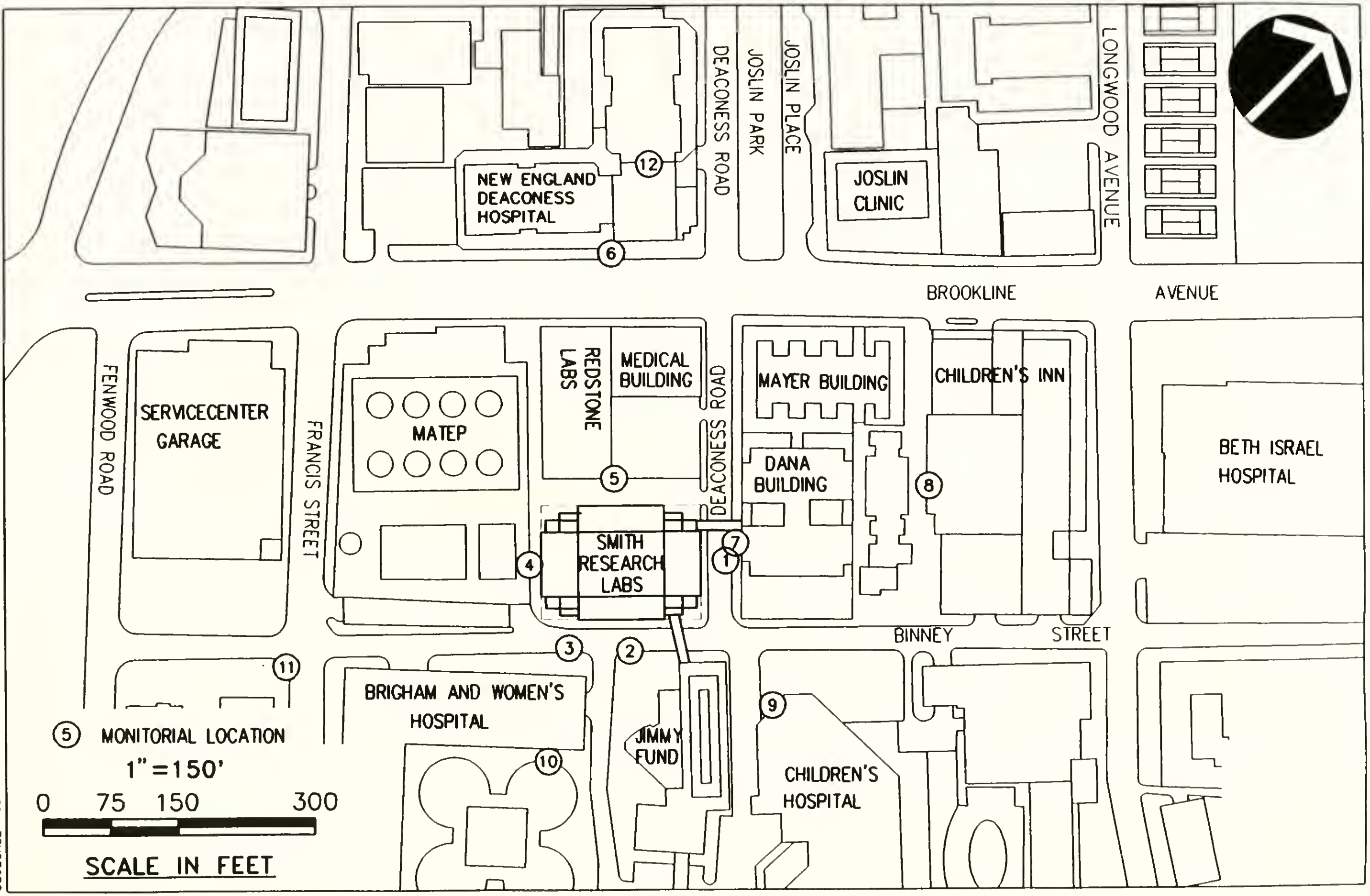


FIGURE V.5-1
NOISE MODELING LOCATIONS
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.

5.2 Summary Model Results

Tables V.5-1 through V.5-12 summarize the noise model results at each of the receptors evaluated (the tables are numbered to correspond to the receptor numbers in Figure V.5-1). It is believed that the Project noise calculated at each modeled receptor represents a conservative, or worst-case, evaluation. Actual Project noise levels at each of the receptors are expected to be lower than predicted by the noise modeling results. Nonetheless, results indicate that the Project can meet the City of Boston Noise Ordinance criteria at all modeled locations, using common mitigation measures.

Table V.5-1: 1) Combined Noise Levels at the Dana Building Property

Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
			Octave Band Center Frequency (Hz)								
1. Cooling Towers	56		70	69	68	61	51	40	27	19	13
2. HVAC Exhaust Vent	41		56	55	54	42	33	33	26	18	9
3. HVAC Intake Louvers	43		26	37	45	44	42	37	30	26	22
4. Parking Garage Exhaust	40		60	58	54	40	28	25	16	11	6
5. Hood Fan Exhaust Stacks	45		61	58	54	49	42	35	30	25	17
COMBINED TOTAL	57	75	71	70	68	61	52	43	35	29	24
Business Zoning Limit (Boston)	65		79	78	73	68	62	56	51	47	44
DIFFERENCE	-8		-8	-8	-5	-7	-10	-13	-16	-18	-20

Table V.5-2: 2) Combined Noise Levels at the Jimmy Fund Building Property Line

Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
			Octave Band Center Frequency (Hz)								
1. Cooling Towers	58		72	71	70	63	53	42	29	21	15
2. HVAC Exhaust Vent	41		56	55	54	42	33	33	26	18	9
3. HVAC Intake Louvers	43		26	37	45	44	42	37	30	26	22
4. Parking Garage Exhaust	5		22	21	18	6	-4	-5	-12	-15	-19
5. Hood Fan Exhaust Stacks	48		64	61	57	52	45	39	33	28	21
COMBINED TOTAL	59	77	73	72	70	63	54	45	36	31	25
Business Zoning Limit (Boston)	65		79	78	73	68	62	56	51	47	44
DIFFERENCE	-6		-6	-6	-3	-5	-8	-11	-15	-16	-19

Table V.5-3: 3) Combined Noise Levels at Brigham and Women's Hospital Property Line

			Octave Band Center Frequency (Hz)								
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	58		72	71	70	63	53	42	29	21	15
2. HVAC Exhaust Vent	38		53	52	51	39	30	29	22	14	5
3. HVAC Intake Louvers	43		26	37	45	44	42	37	30	26	22
4. Parking Garage Exhaust	17		34	33	30	18	8	7	1	-2	-4
5. Hood Fan Exhaust Stacks	48		64	61	57	52	45	39	33	28	21
COMBINED TOTAL	59	77	73	72	70	63	54	45	36	31	25
Business Zoning Limit (Boston)	65		79	78	73	68	62	56	51	47	44
DIFFERENCE	-6		-6	-6	-3	-5	-8	-11	-15	-16	-19

Table V.5-4: 4) Combined Noise Levels at the MATEP Property Line

			Octave Band Center Frequency (Hz)								
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	59		73	72	70	63	54	43	30	22	16
2. HVAC Exhaust Vent	36		51	50	49	37	28	28	20	13	3
3. HVAC Intake Louvers	43		26	37	45	44	42	37	30	26	22
4. Parking Garage Exhaust	43		63	61	57	43	31	28	19	14	9
5. Hood Fan Exhaust Stacks	51		67	64	60	55	48	42	37	32	25
COMBINED TOTAL	60	78	74	73	71	64	55	46	39	33	27
Industrial Zoning Limit (Bosto	70		83	82	77	73	67	61	57	53	50
DIFFERENCE	-10		-9	-9	-6	-9	-12	-15	-18	-20	-23

Table V.5-5: 5) Combined Noise Levels at Adjacent Property to the West

Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
			Octave Band Center Frequency (Hz)								
1. Cooling Towers	59		73	72	71	64	54	43	30	22	16
2. HVAC Exhaust Vent	41		56	55	54	42	33	33	26	18	9
3. HVAC Intake Louvers	38		21	32	40	39	37	32	25	21	17
4. Parking Garage Exhaust	59		76	75	72	60	50	49	43	40	38
5. Hood Fan Exhaust Stacks	49		65	62	57	52	45	39	34	29	22
COMBINED TOTAL	62	82	78	77	75	66	56	51	44	41	38
Business Zoning Limit (Boston)	65		79	78	73	68	62	56	51	47	44
DIFFERENCE	-3		-1	-1	2	-2	-6	-5	-7	-6	-6

Table V.5-6: 6) Combined Noise Levels at Deaconess Building to the West

Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
			Octave Band Center Frequency (Hz)								
1. Cooling Towers	48		62	61	60	53	43	32	18	8	1
2. HVAC Exhaust Vent	29		44	43	42	30	21	20	12	4	-8
3. HVAC Intake Louvers	20		4	15	22	21	19	14	6	1	-5
4. Parking Garage Exhaust	40		57	56	53	41	31	29	22	18	13
5. Hood Fan Exhaust Stacks	28		44	41	37	32	25	18	13	6	-3
COMBINED TOTAL	49	67	63	62	61	53	43	34	24	19	14
Business Zoning Limit (Boston)	65		79	78	73	68	62	56	51	47	44
DIFFERENCE	-16		-16	-16	-12	-15	-19	-22	-27	-28	-30

Table V.5-7: 7) Combined Noise Levels at Dana Building Rooms

			Octave Band Center Frequency (Hz)								
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	44		62	61	56	46	39	33	25	23	22
2. HVAC Exhaust Vent	40		55	54	53	41	32	32	24	17	7
3. HVAC Intake Louvers	40		24	35	42	41	39	34	27	23	19
4. Parking Garage Exhaust	39		59	57	53	39	27	24	15	10	5
5. Hood Fan Exhaust Stacks	43		59	56	52	47	40	34	29	23	16
COMBINED TOTAL	49	69	66	64	60	51	45	39	33	28	24
Residential Zoning Limit (Bost	50		68	67	61	52	45	40	33	28	26
DIFFERENCE	-1		-2	-3	-1	-1	0	-1	0	0	-2

Table V.5-8: 8) Combined Noise Levels at the Children's Inn Rooms

			Octave Band Center Frequency (Hz)								
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	38		55	55	49	41	33	27	19	15	12
2. HVAC Exhaust Vent	32		47	46	45	33	24	24	16	8	-2
3. HVAC Intake Louvers	34		17	28	36	35	33	28	20	15	10
4. Parking Garage Exhaust	34		54	52	48	34	22	18	10	3	-3
5. Hood Fan Exhaust Stacks	39		55	52	48	43	36	30	24	18	9
COMBINED TOTAL	43	63	60	58	54	46	39	34	27	21	16
Residential Zoning Limit (Bost	50		68	67	61	52	45	40	33	28	26
DIFFERENCE	-7		-8	-9	-7	-6	-6	-6	-6	-7	-10

Table V.5-9: 9) Combined Noise Levels at Children's Hospital Rooms

							Octave Band Center Frequency (Hz)				
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	42		59	58	53	44	37	31	23	19	16
2. HVAC Exhaust Vent	32		47	46	45	33	24	24	16	8	-2
3. HVAC Intake Louvers	35		18	29	37	36	34	29	22	17	12
4. Parking Garage Exhaust	0		17	16	13	1	-9	-10	-17	-21	-25
5. Hood Fan Exhaust Stacks	41		57	54	50	45	37	31	26	20	11
COMBINED TOTAL	45	64	61	60	55	48	41	35	29	24	19
Residential Zoning Limit (Bost	50		68	67	61	52	45	40	33	28	26
DIFFERENCE	-5		-7	-7	-6	-4	-4	-5	-4	-4	-7

Table V.5.10: 10) Combined Noise Levels at the Brigham and Women's Rooms

							Octave Band Center Frequency (Hz)				
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	42		59	58	53	44	37	31	23	19	16
2. HVAC Exhaust Vent	31		46	45	44	32	23	23	15	7	-4
3. HVAC Intake Louvers	35		18	29	37	36	34	29	21	17	11
4. Parking Garage Exhaust	0		17	16	13	1	-9	-11	-17	-22	-26
5. Hood Fan Exhaust Stacks	46		62	59	55	50	43	36	31	26	18
COMBINED TOTAL	47	67	64	62	57	51	44	38	32	27	21
Residential Zoning Limit (Bost	50		68	67	61	52	45	40	33	28	26
DIFFERENCE	-3		-4	-5	-4	-1	-1	-2	-1	-1	-5

Table V.5-11: 11) Combined Noise Levels at the Nearest Residences

			Octave Band Center Frequency (Hz)								
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	35		54	53	47	37	29	23	16	13	10
2. HVAC Exhaust Vent	26		42	41	40	27	18	18	10	0	-12
3. HVAC Intake Louvers	23		7	18	26	25	23	17	10	4	-2
4. Parking Garage Exhaust	0		21	17	13	1	-9	-11	-18	-23	-28
5. Hood Fan Exhaust Stacks	36		52	49	45	40	33	26	20	14	4
COMBINED TOTAL	39	59	56	55	50	42	35	29	22	17	11
Residential Zoning Limit (Bost	50		68	67	61	52	45	40	33	28	26
DIFFERENCE	-11		-12	-12	-11	-10	-10	-11	-11	-11	-15

Table V.5-12: 12) Combined Noise Levels at the Deaconess Hospital Rooms

			Octave Band Center Frequency (Hz)								
Contributing Source	dBA	OA	31.5	63	125	250	500	1000	2000	4000	8000
1. Cooling Towers	37		55	54	49	40	32	26	18	13	10
2. HVAC Exhaust Vent	28		43	42	41	29	20	19	12	3	-9
3. HVAC Intake Louvers	19		3	14	22	21	18	13	5	0	-6
4. Parking Garage Exhaust	39		56	55	52	40	30	28	22	17	12
5. Hood Fan Exhaust Stacks	36		52	49	45	40	33	26	21	14	5
COMBINED TOTAL	43	63	60	59	55	45	37	32	25	20	15
Residential Zoning Limit (Bost	50		68	67	61	52	45	40	33	28	26
DIFFERENCE	-7		-8	-8	-6	-7	-8	-8	-8	-8	-11

6.0 GEOTECHNICAL CONCERNS

The BRA's ·AD stated that the impact of the permanent dewatering system on groundwater level maintenance in the adjacent areas should be evaluated in the FPIR/FEIR. Additional information on foundation construction and dewatering is provided below.

6.1 Foundation Construction

To isolate the building from vibrations generated by the adjacent MATEP facility, the building must be founded on bedrock and be isolated from the surrounding soil. To accomplish this, the basement walls will be constructed as slurry walls extending to bedrock, with lateral support provided by permanent tiebacks anchored into the glacial till and bedrock. The basement floors and building superstructure will be supported on a combination of spread footings and short caissons founded on bedrock. The basement floors will be isolated from the basement walls by isolation joints located just inside the walls.

The slurry walls and tiebacks for the permanent basement walls will also serve as the excavation support system during construction. The slurry walls will be designed to control ground movement outside the excavation and protect the adjacent buildings and utility tunnel. The slurry walls will also provide a groundwater cut-off to bedrock. The tiebacks will be installed at an inclination to avoid adjacent building foundations and utilities.

6.2 Protection of Surrounding Structures

The MATEP facility is located about eight feet southwest of the site and is founded on a mat bearing at about El. 10. Excavation support for construction of the MATEP facility consisted of an anchored soldier pile and lagging wall. The anchors are still in place but are not required for support of the permanent wall. The Dana Building is about 45 feet northeast with its basement at about El. 30, and a sub-basement about 55 › 60 feet from the site, at El. 17. A concrete utility tunnel beneath Binney Street is about 15 feet southeast of the site. Drawings for the tunnel indicate that the bottom of the tunnel varies between El. 8.5 and 13.5 in the vicinity of the site. The tunnel is about 14 feet square. The Jimmy Fund Building across Binney Street from the site, appears to be supported on footings bearing at El. 28.

The slurry walls will be designed to control ground movement below the adjacent structures and utilities during excavation. The slurry walls will be much stiffer than conventional excavation support systems and will be toed into bedrock to prevent movement of the bottom of the wall. The vertical

spacing of the tieback anchors will be designed to coincide with the basement floor levels, resulting in a relatively close spacing which will help to minimize wall movement during excavation. A geotechnical instrumentation program will be established to monitor movement of the slurry walls and adjacent structures during construction.

6.3 Dewatering

The ground surface at the site is approximately E1.43 feet, and the bottom of the structure (Level P6) will be at approximately E1-21, with a partial lower level for mechanical equipment at approximately E1.-31. The lowest level (E1.-31) is about 40 to 50 feet below groundwater level.

The slurry walls will extend to bedrock to provide a groundwater cut-off through the relatively pervious sand and glacial till strata located above the bedrock. The bottom level floor slabs will be designed as pressure-relieved slabs with an under-slab drainage system. The groundwater cut-off provided by the slurry walls will be used to minimize flow into the under-slab drainage system and to minimize groundwater drawdown outside the building. The slurry walls will also provide a groundwater cut-off for construction dewatering.

It is expected that groundwater drawdown in the soil outside the slurry walls will be minimal because the sand and glacial till strata above the bedrock are more permeable than the rock. As a precaution, grout sleeves will be installed inside the slurry walls so that any localized pervious zones in the rock below the slurry wall can be sealed by grouting. If some groundwater drawdown does occur outside the slurry walls due to unforeseen conditions, the impact on adjacent structures should be minimal because the clay stratum is heavily preconsolidated in this area.

Permits for dewatering will be obtained from the EPA (NPDES), DEP and Boston Water and Sewer Commission prior to commencing construction activities.

7.0 CONSTRUCTION IMPACTS

The BRA's PAD stated that the proximity of the site to residences on Francis Street raises concern that construction hours may need to be restricted. In addition, inconsistencies between the date in DPIR/DEIR Table V.7-2 and V.9-2 need to be clarified. The PAD recommended that demolition and construction waste be recycled to the extent possible rather than disposed of in scarce landfills. In addition, the City encouraged Dana-Farber to provide T-passes to construction workers to discourage parking in the area.

These issues are addressed in the revised construction impacts section below. In addition, an update on the project schedule, construction staging and the traffic maintenance plan is presented.

7.1 Construction Schedule

The construction of the Smith Research Laboratories is expected to start with site preparation and demolition of on-site buildings in July 1994 and continue for approximately 36 months. Normal construction hours for the Project will be from 7:00 AM to 4:00 PM, Monday through Friday. Certain construction activities such as steel erection, foundation preparation, and concrete casting may require extended hours or work on Saturdays.

A preliminary construction schedule is shown on Figure V.7-1. The first phase of construction will include initial site preparation work and demolition. The Frederika Building and the small garage on the site will be demolished. A small back portion of the Redstone Building will also be demolished. These buildings will first be cleared of any asbestos. Asbestos removal will be conducted by a licensed contractor and will be handled and disposed of according to all applicable regulations. Building demolition will commence in July 1994 and be completed in approximately two months.

The proposed garage will be located below-grade, under the Smith Research Laboratories. The work on the garage will commence in October 1994 and be completed in October 1995. During this phase, excavation of the below-grade area will occur as well as utility locations and dewatering.

Following completion of the sub-grade structure, construction of the superstructure will begin. Erection of the structural steel is expected to take approximately seven months, during which time the slab at all levels and mechanical penthouse level will also be poured. After the exterior walls are constructed, the interior finishing work will proceed and is expected to last

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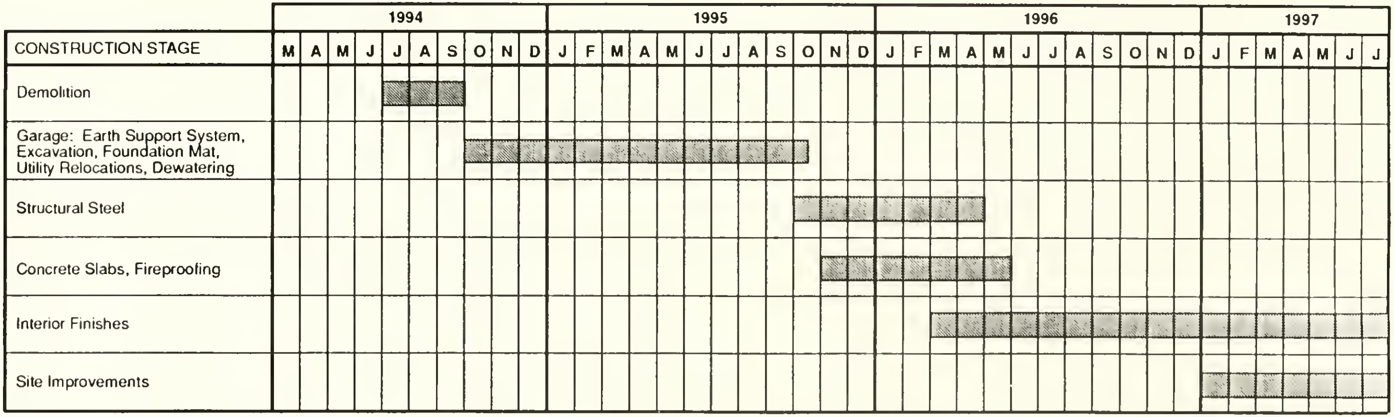

FIGURE V.7-1
PRELIMINARY CONSTRUCTION SCHEDULE
SMITH RESEARCH LABORATORIES

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approximately 17 months. During the final stages of construction, on-site and off-site street improvements will be completed.

7.2 Construction Staging and Perimeter Protection

An on-site staging area will be located on the west side (adjacent to the 454 Brookline Avenue parking lot) of the site to isolate the construction area and to minimize disruption in adjacent areas. During part of the excavation phase, there will be temporary staging areas developed elsewhere on the site while the west side is prepared. Because of the limitations of the site, it is anticipated that truck unloading and foundation installation will require temporary use of portions of the sidewalks and Deaconess Road and Binney Street adjacent to the site. Figure V.7-2 shows the proposed staging area and truck unloading areas.

A detailed Traffic Maintenance Plan is currently under review with the City and will be submitted shortly to the Boston Transportation Department. The street and sidewalk closings described below may change following completion of discussions with the Boston Transportation Department.

Sidewalks

The sidewalk on the north (Dana Building) side of Deaconess Road will be maintained for pedestrian use at all times during construction. It is anticipated that the sidewalk adjacent to the site will be closed to pedestrian traffic from the Redstone Building service drive to the corner of Binney Street. Pedestrians will be diverted to the north side of Deaconess Road at the corner of Brookline Avenue or near the entrance to the parking lot west of the site.

The sidewalk on the east (Jimmy Fund Building) side of Binney Street will be maintained for pedestrians throughout construction. It is anticipated that the sidewalk adjacent to the site on the west side of Binney Street will be closed to pedestrian traffic from the MATEP facility to the corner of Deaconess Road. Pedestrians will be diverted to the east side of Binney Street at the corner of Francis Street or at the MATEP service entrance.

Both of these sidewalk closings will be necessary for installation of the foundation system needed for the installation of the slurry wall.

Although not a public way, the lightly-traveled walkway between the site and MATEP and extending from Binney Street to Brookline Avenue will be closed to pedestrians except that egress from the Redstone Building will be maintained.

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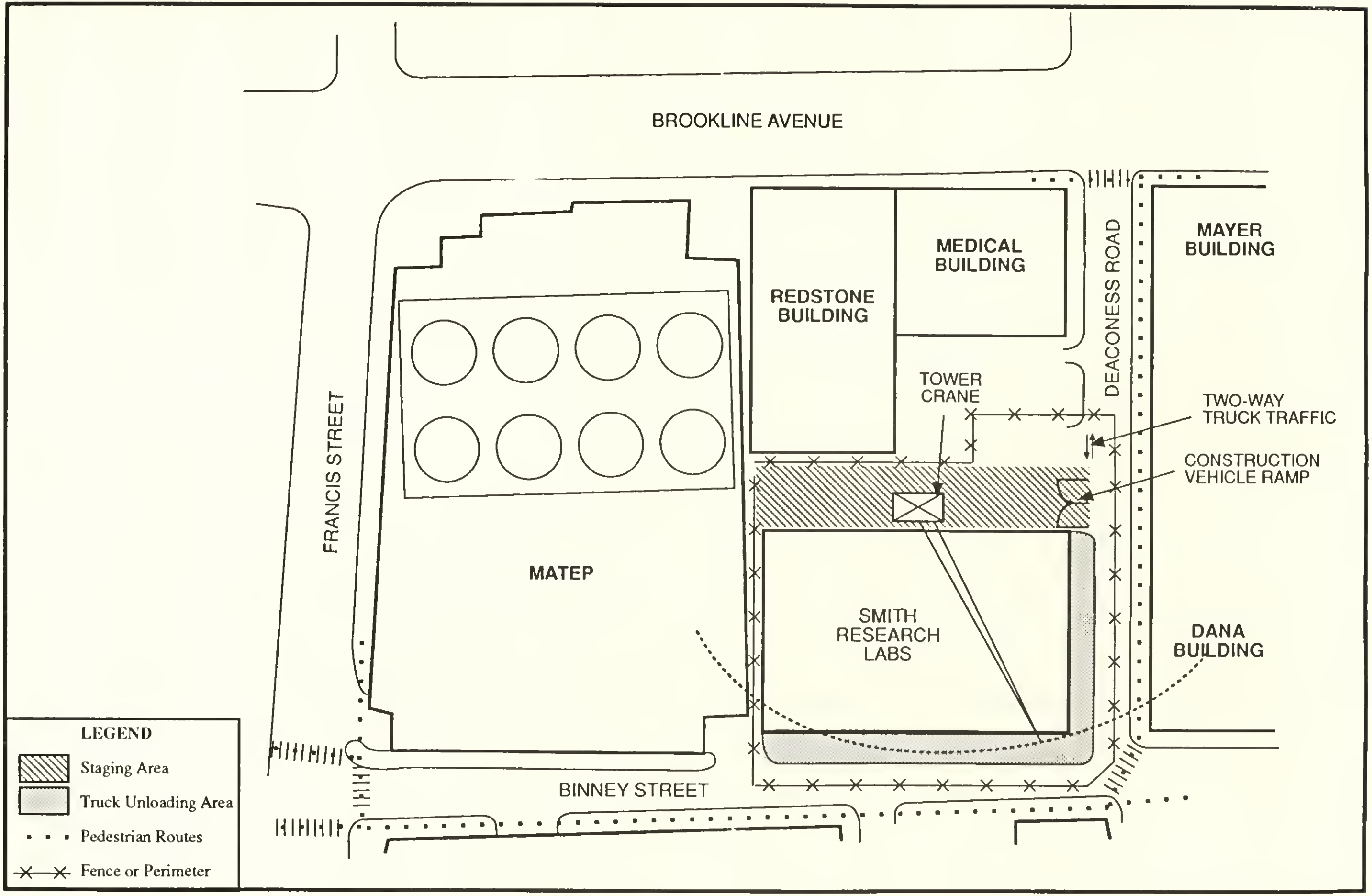

FIGURE V.7-2
CONSTRUCTION STAGING
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Streets

To make removal of excavated material and deliveries to the site in an orderly manner, it is proposed to use a portion of Deaconess Road for a truck loading area adjacent to the site. This lane would be fenced off from the west corner of the site to the corner of Binney Street to separate it from pedestrian and vehicular traffic. It is also anticipated that a portion of Binney Street will be required to complete the foundation work for the garage and for the earth support system. Dana-Farber is currently completing discussions with the Boston Transportation Department on construction access and possible street direction changes around the site during the construction period.

7.3 Truck Routes and Volumes

Trucks will be used to remove material excavated from the site and to deliver construction materials to the site. The level of traffic will vary throughout the project depending on the specific construction phase. The greatest volume of truck traffic can be expected during excavation and foundation casting operations when up to four to five trucks per hour can be expected to enter and leave the site. These estimated volumes will be refined when the construction schedule is finalized.

Limiting the effect of construction traffic and noise on the adjacent neighborhoods will be a goal of the truck routing plan. Routes will be chosen that use major thoroughfares as much as possible. Trucks will be routed away from nearby residential areas. Particular restrictions along Francis Street between Binney Street and Brigham Circle will be employed by the contractor.

7.4 Employee Trip Generation and Construction Worker Parking

The number of workers required during construction will vary with an estimated peak work force of approximately 150 to 200 workers. As the construction workers arrive between 6:00 and 7:00 AM and depart between 3:00 and 4:00 PM, the construction traffic is not expected to have a significant impact on the peak hour traffic.

Construction workers will be encouraged to use public transportation. Secured storage for tools will be provided on-site so that workers will not have to transport their tools to and from the site on a daily basis, thereby alleviating the need to drive to the site.

In order to discourage driving to the site, no on-site parking will be available for personal vehicles. Past experience shows that the lack of free or subsidized parking discourages use of personal vehicles and increases carpooling.

Construction workers who do drive will use off-street commercial parking spaces. The Institute will also discuss with MASCO the possibility of workers using off-site facilities operated by MASCO in the Fenway or other locations.

7.5 Reuse/Recycling

Dana-Farber will take an active role with regard to the reprocessing and recycling of demolition waste. The demolition and disposal contract will include specific requirements that will ensure that demolition procedures allow for the necessary segregation, reprocessing, reuse and recycling of materials. For those matters that cannot be recycled, the contractor will transport solid waste in covered trucks to an approved solid waste facility, per DEP's Regulations for Solid Waste Facilities, 310 CMR 16.0. The demolition disposal contract will specify this requirement.

After discussions with private demolition contractors, Dana-Farber will consider the following practices and reuse and recycling of demolition materials:

- Demolition will be conducted so that materials that may be recycled are segregated from those materials not recyclable to enable disposal at an approved solid waste facility.

- Brick, concrete and asphalt will be evaluated for its reprocessing opportunities to be used as fill or reused as a construction material.

- Wood containing glues, paints or other chemical preservatives cannot be recycled and will be separated for disposal at an approved facility. All "clean" wood may either be transported to a wood-chipping facility or reused as timber. If chipped, wood chips could then be sold to local landscaping companies. Otherwise, plankings may be sold to construction companies for construction or restoration projects.

- Much of the steel and iron may be recycled. Copper piping and copper wire may be recycled as well. Recycling would consist of melting down and refabricating new products. These materials may be sold to one or more of a number of scrap metal companies in the area.

VI. URBAN DESIGN COMPONENT

DANA-FARBER
CANCER INSTITUTE

VI. URBAN DESIGN COMPONENT

1.0 STATUS OF PROJECT DESIGN

The Project has been favorably reviewed by the Boston Civic Design Commission which approved the Project's revised design on March 8, 1994. The revised schematic design was approved by the Boston Redevelopment Authority on March 10, 1994. Further plans and specifications for the Smith Research Laboratories will be submitted to the Authority for approval in accordance with the Authority's "Development Review Procedures", 1985, Revised 1986.

The BRA's PAD concluded that the urban design issues raised in the Scoping Determination were adequately addressed in the DPIR, and that subsequent issues raised in reviews by the Mission Hill PZAC and the Boston Civic Design Commission had been adequately addressed in the Project Proponent's Schematic design drawings dated January 7, March 1 and March 4, 1994. The following sections includes a discussion of the Project's revised design with comparisons to the DPIR/DEIR design, as appropriate.

2.0 SITE SELECTION

The site for the Smith Research Laboratories is the only property owned by Dana-Farber in the LMA that is essentially undeveloped. The site is also adjacent to all of Dana-Farber's existing facilities.

Alternative sites were considered in the DPIR/DEIR including use of property fronting on Brookline Avenue to address the BRA's desire to improve the character of the streetscape along Brookline Avenue. This alternative required use of Dana-Farber's Redstone Building, which is currently occupied by an animal laboratory. Such a location, however, did not allow for the efficient use of space within the Smith Research Laboratories, due to the narrow footprint of the Redstone Building along Brookline Avenue and the construction requirement that the below-grade parking garage remain at the original Deaconess Road site. Figure VI.2-1 shows the proposed site, the adjacent Redstone Building site along Brookline Avenue and other structures on the Dana-Farber campus.

No alternative sites outside of the LMA were identified by the Institute as Dana-Farber does not own developable property outside of the LMA. In addition, the close physical link between the proposed site and Dana-Farber's existing facilities and other LMA institutions is important to unite cancer

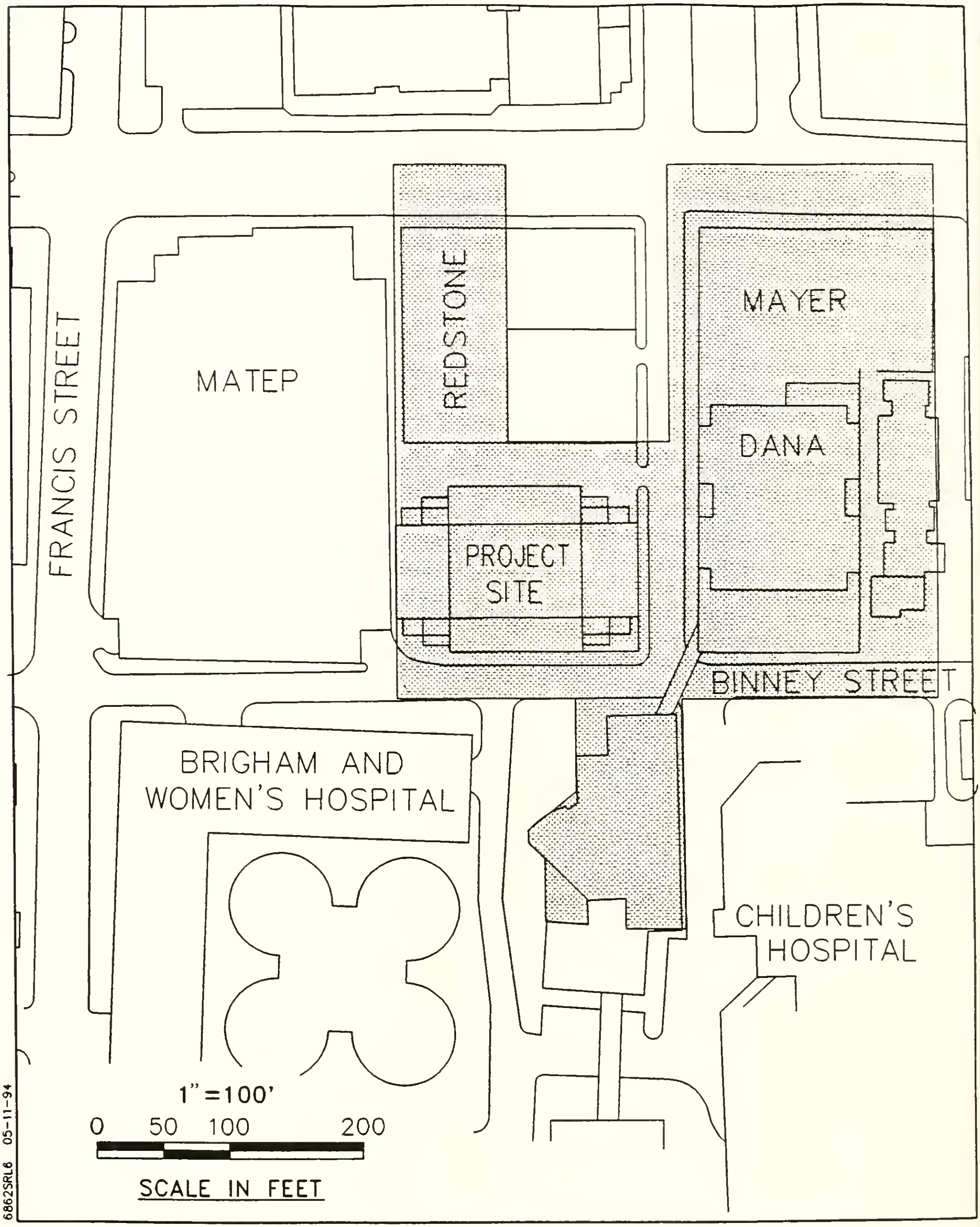

FIGURE VI.2-1
DANA-FARBER CAMPUS
SMITH RESEARCH LABORATORIES

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research and treatment and promote effective interaction between researchers and clinicians. Siting the new laboratory outside of the LMA would not support these objectives.

3.0 BUILDING DESIGN

The BRA's Scoping Determination for the DPIR directed Dana-Farber to investigate methods for minimizing the visual impact of the Smith Research Laboratories' height and bulk. In response to this directive, the Project architects held a number of design review meetings with the BRA and the Boston Civic Design Commission (BCDC) to explore massing refinements. As a result of these meetings, the original building program was reduced from 267,000 gsf to 238,320 gsf for floor area ration (FAR) purposes (322,000 gsf to 290,000 gsf for MEPA purposes), representing a reduction of about 30,000 gsf, or the equivalent of one and one-half floors from the PNF/ENF proposal. The floor plate was also reduced from 23,000 to 21,500 gsf, and the FAR reduced from 10.2 to 8.3 with the DPIR/DEIR project (additional reductions since the DPIR/DEIR are described below).

The DPIR/DEIR project depicted a building mass that was substantially modified through the design review process by stepping back the upper corners to taper the mass, by differentiating the materials of the middle of the building from those of the corners to emphasize slimmer proportions, and by articulating the top of the central bay below the penthouse levels to minimize apparent height.

Since filing of the DPIR/DEIR, additional design review by BRA staff, the BCDC and Mission Hill PZAC, resulted in further design improvements and refinements, as follow:

- *Sidewalk Setback Along Binney Street* - The street-level building arcade was deleted and the sidewalk width along Binney Street increased from approximately 7 feet to 19 feet. This change provides substantially more pedestrian circulation space and ambient light along Binney Street, as well as additional setback to the high building wall which moderates the abrupt change of scale at the pedestrian level.

- *Garage Access* - The ramps to the below-grade parking garage have been relocated to within the building where they will be less noticeable than in their previous location alongside the building. Garage doors in the new location will also be used to conceal the ramps and improve the building's appearance.

- *Parking Garage* - Total parking has been reduced from 261 to 246 spaces, requiring the use of six below-grade levels for parking.

- *Pedestrian Bridges* - The public streetscape has been improved by the deletion of the existing pedestrian bridge connecting the Jimmy Fund and Dana Building at the second floor, crossing Binney Street diagonally. A new replaement bridge and a second bridge crossing at Deaconess Road will be installed at the third floor, 24 feet above the street level.

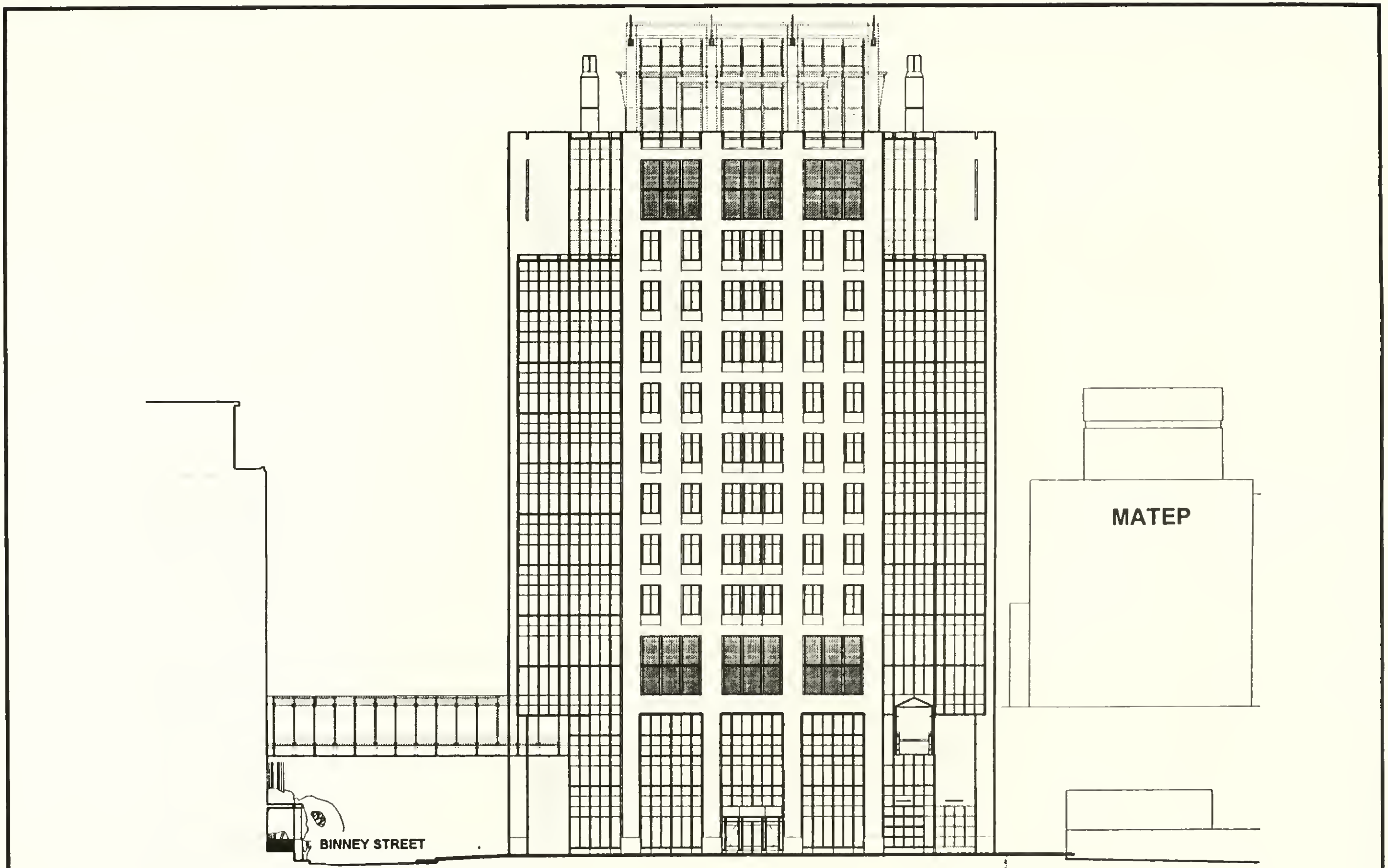
- *Building Height and Bulk* - One floor of research space has been deleted from the program. This results in a reduction in building height of 10 feet from 194 to 184 feet; FAR gross floor area from 38,320 to 213,592 square feet (290,000 to 265,000 gsf for MEPA purposes); and FAR from 8.3 to 7.4.

Figures VI.3-1 through VI.3-4 show elevations for the Smith Research Laboratories. The height and mass of the Project relates to other nearby buildings. The laboratory structure will also mask the view of MATEP's large northeast blank wall and rooftop mechanical equipment from Binney Street and Deaconess Road. The new building also fills in a street wall gap and allows for continuity in the streetscape plan which provides for new pedestrian areas.

4.0 STREETSCAPE

4.1 Pedestrian Bridges

Two new covered pedestrian bridges are proposed as part of the Project. These bridges are needed to facilitate pedestrian flow between programmatically linked activities of surrounding institutions as well as to ensure circulation of employees and patients in some care units. One bridge will span Deaconess Road and will link the Smith Research Laboratories with the Dana Building. The bridge previously proposed between the Smith Research Laboratories and Brigham and Women's Hospital is no longer part of the Project. Instead, the existing bridge connecting the Dana Building to the Jimmy Fund Building, which is heavily used by employees, will be replaced with a higher bridge connecting the Project to the Jimmy Fund Building. This replacement bridge will be less intrusive on the pedestrian environment, because it will be at the third floor, instead of at the second floor as currently exists. It will also be more visually pleasing, being at a right angle to Binney Street and constructed of materials to give it a light appearance.



SHEPLEY BULFINCH RICHARDSON AND ABBOTT

FIGURE VI.3-1
NORTH ELEVATION
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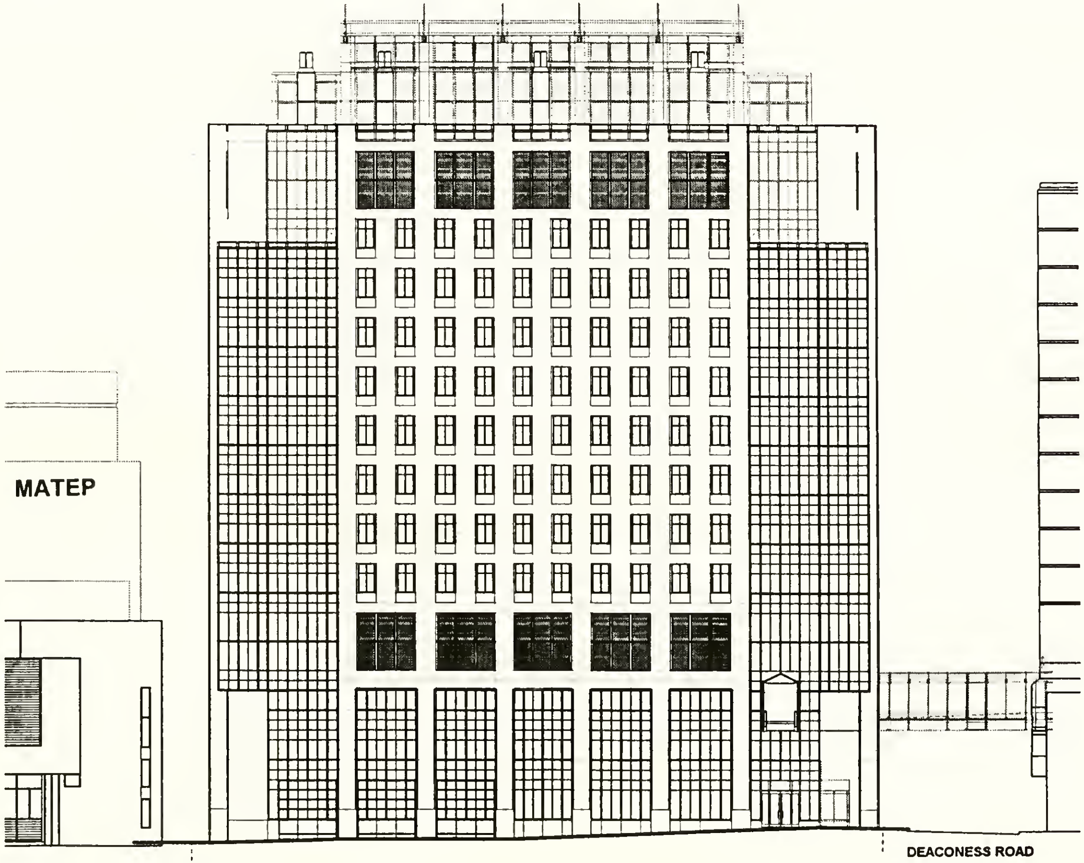

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FIGURE VI.3-2
EAST ELEVATION
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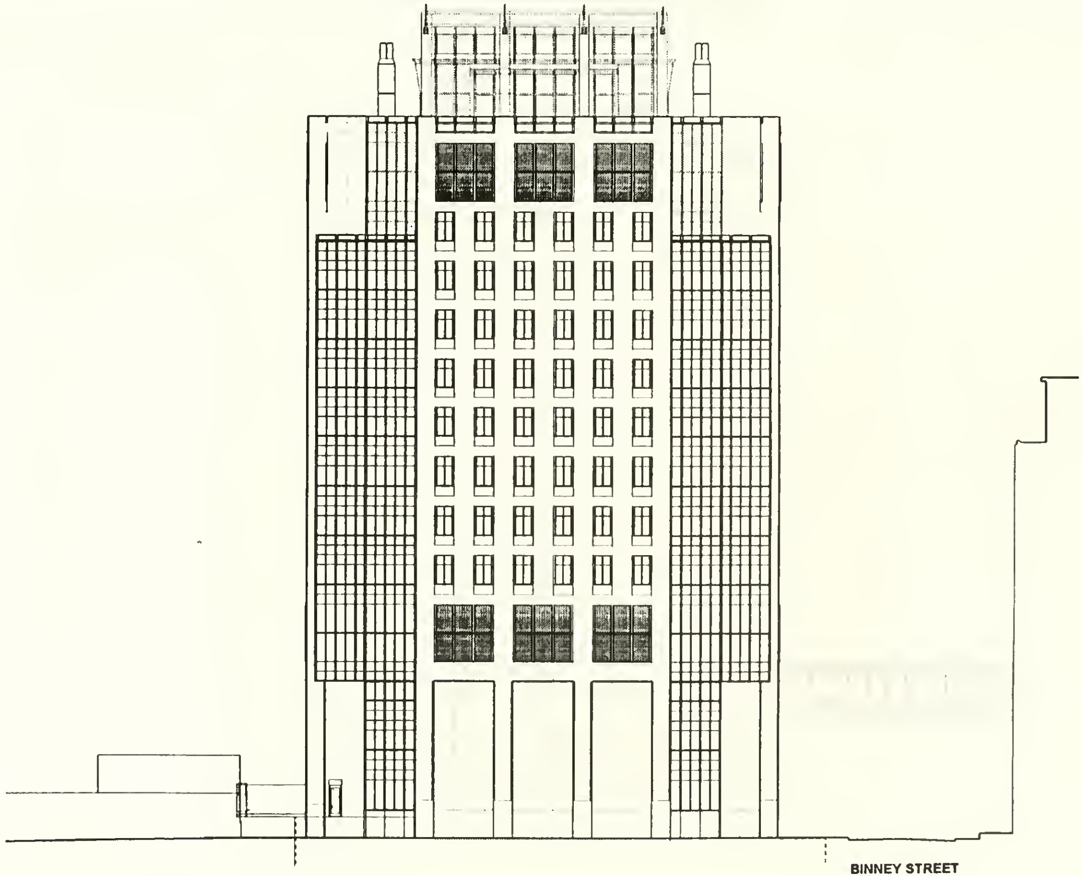

FIGURE VI.3-3
SOUTH ELEVATION
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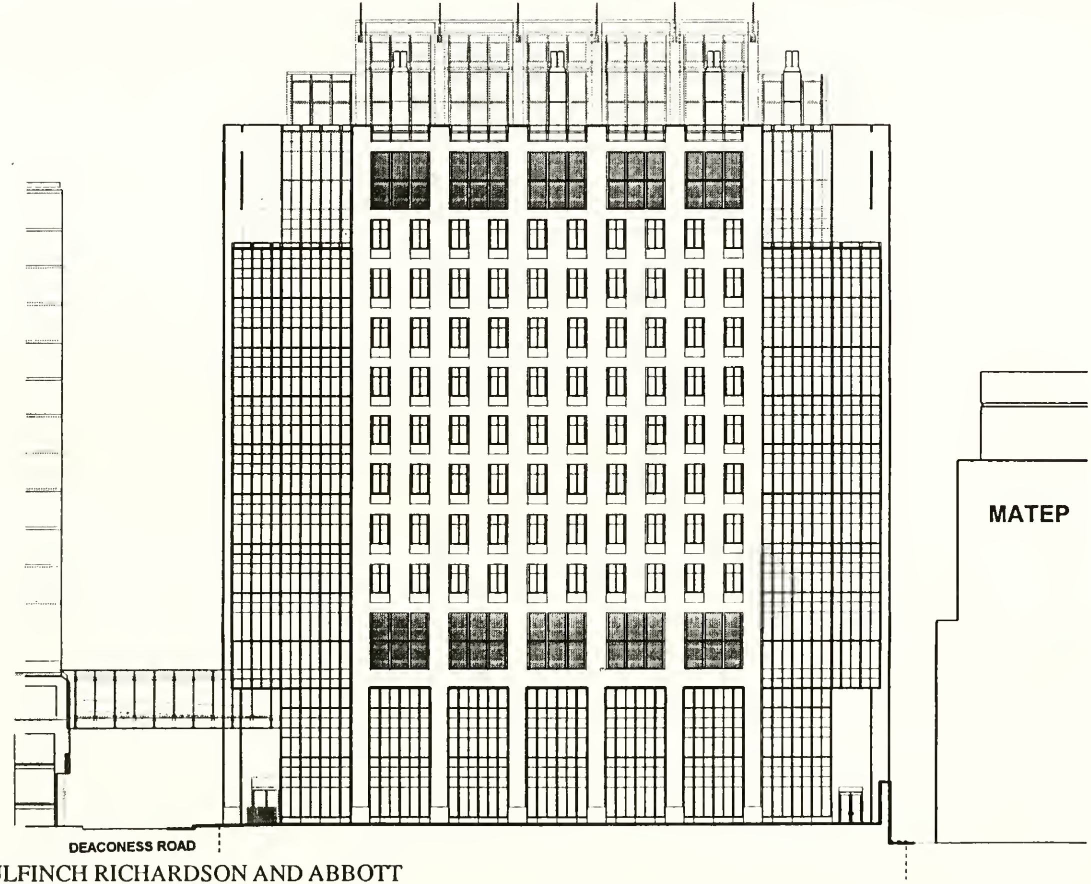

FIGURE VI.3-4
WEST ELEVATION
SMITH RESEARCH LABORATORIES

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Both the new and replacement bridges will be about ten feet wide, in order to minimize the effects of daylight obstruction on the sidewalks below or of increasing pedestrian level winds. These bridges will be mostly glazed to give a light and transparent appearance. Figure VI.4-1 show the section of the bridge along Deaconess Road.

4.2 Pedestrian and Vehicular Circulation

4.2.1 Pedestrian Circulation

The Smith Research Laboratories will provide an expanded sidewalk along Binney Street (19 feet) by shifting the placement of the building to the west. In addition, a two-story entrance canopy, which shelters pedestrians, is included at the base of the building along Deaconess Road. An outside plaza will be provided along the west side of the building. Figure VI.4-2 shows pedestrian circulation around the Smith Research Laboratories. Site lighting will enhance the pedestrian scale while also providing a secure well-lit environment.

4.2.2 Sidewalk Improvements

New concrete sidewalks along Deaconess Road and Binney Street will be installed along with a new paved plaza on the west side of the building. Street accessories will be consistent with street furniture installed by other medical facilities within the LMA. Curb cuts will be paved as continuations of the sidewalk. Dana-Farber will also install new sidewalks along Binney Street in front of other Dana-Farber buildings.

On-site improvements will include planters and new trees along the Binney Street sidewalk, and new shrubs and trees along the west side of the building along the outside plaza. Off-site improvements include construction of a new wall and installing a new planter between the Dana and Shields Warren buildings along Binney Street to mask the view of the adjacent Dana-Farber loading dock. Improvements will also be made to the paved areas at the canopied entrance to the Dana Building. These improvements are shown in Figure VI.4-3.

4.2.3 Service Areas

The entrance/exit to the below-grade garage will be within the building at the ground floor along Deaconess Road. The loading dock and service area will be off-street and covered along Binney Street to ensure that service vehicles

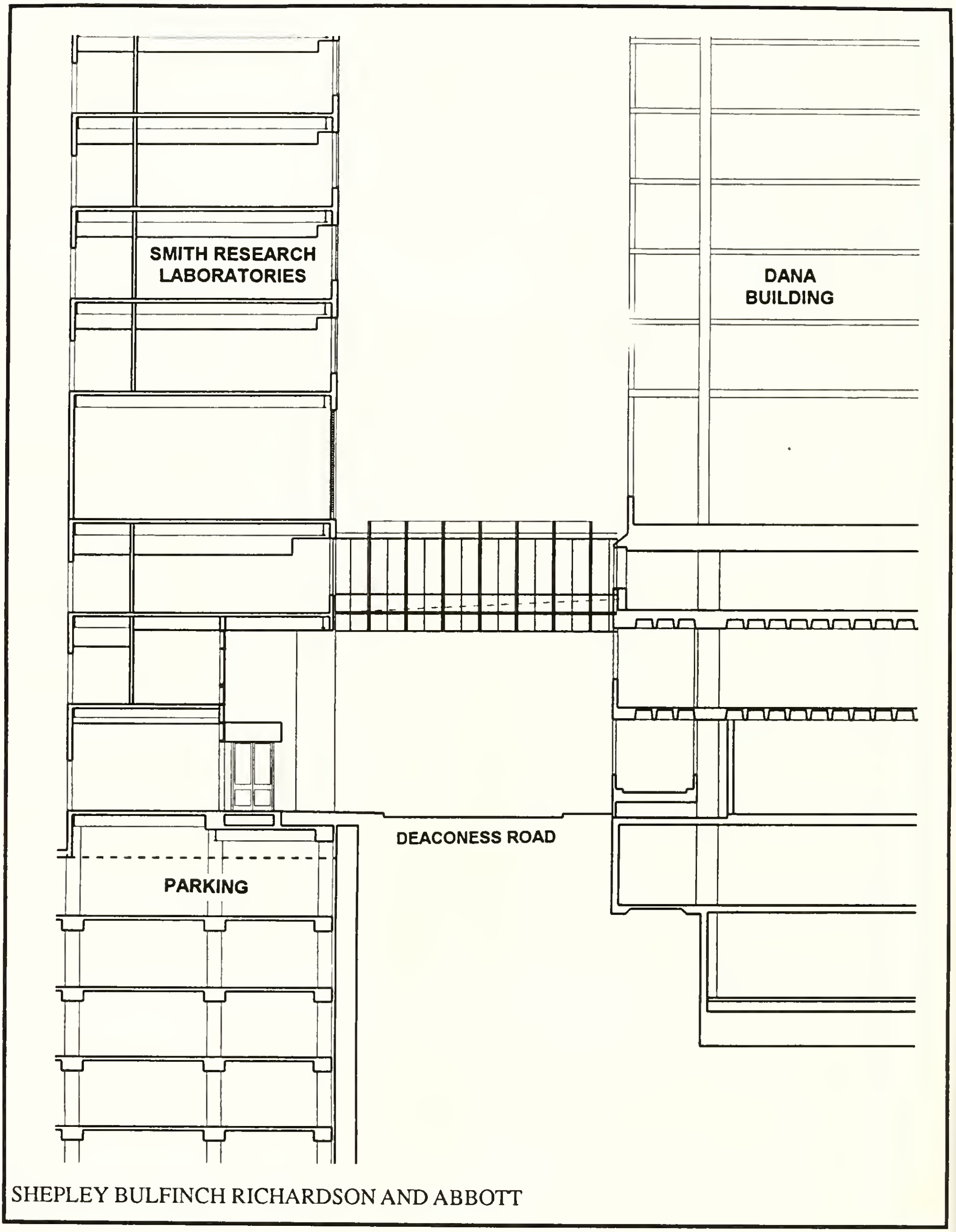

FIGURE VI.4-1
DEACONESS ROAD SECTION
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SHEPLEY BULFINCH RICHARDSON AND ABBOTT

FIGURE VI.4-2
PEDESTRIAN AND VEHICULAR CIRCULATION
SMITH RESEARCH LABORATORIES

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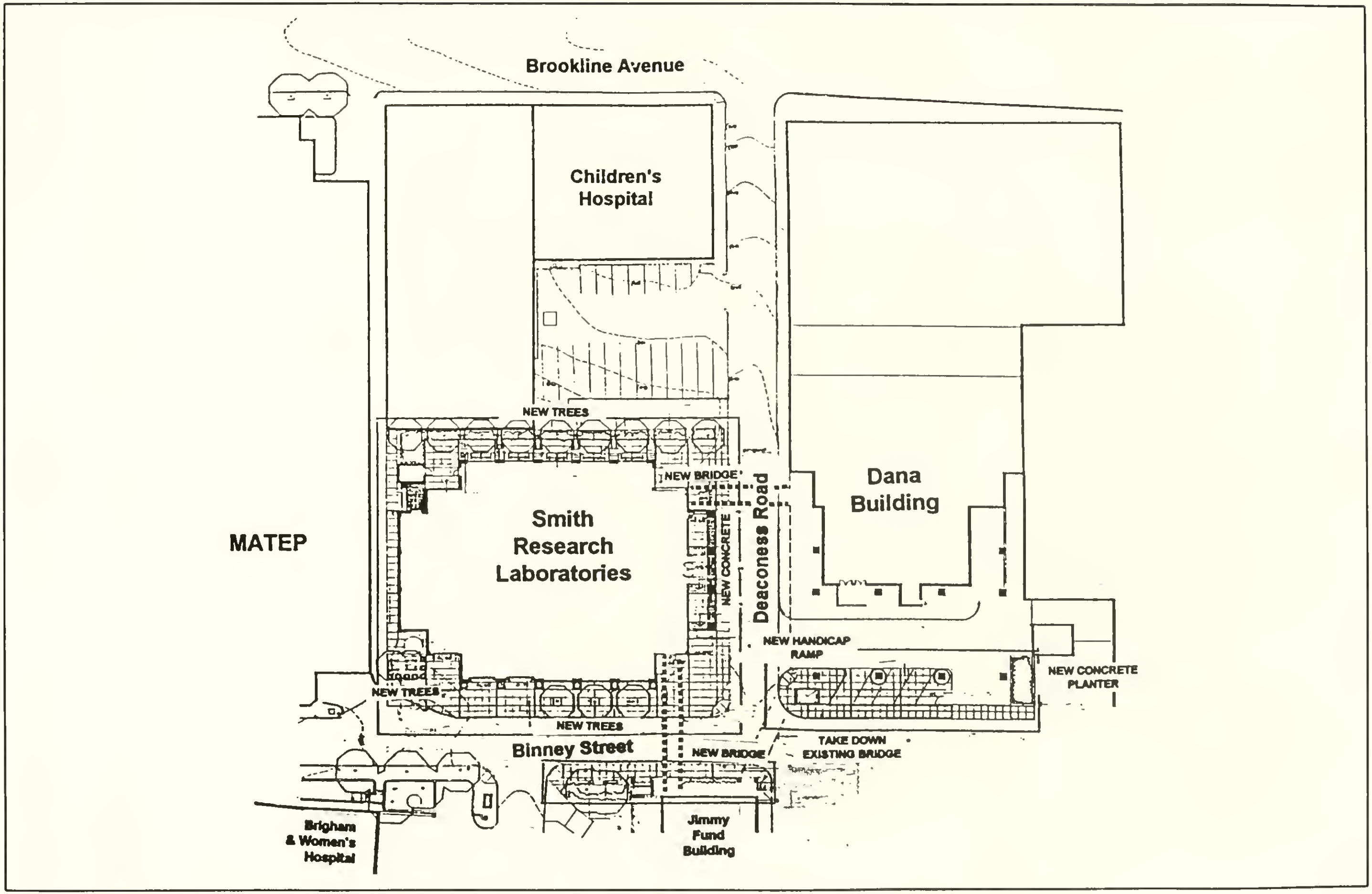

FIGURE VI.4-3
STREETSCAPE IMPROVEMENTS
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will not be visible from, nor interfere with pedestrian movement along Binney Street.

Only three to four trucks per day are expected to use the new loading docks, as the Dana Building service area at 44 Binney Street will continue to be the primary receiving area for the Institute. Much of what is destined for the Smith Research Laboratories will be unloaded at the main loading dock at 44 Binney Street, since the same vendors will continue to be used. In addition, the Smith Research Laboratories will not need clinical or pharmacy supplies, minimizing the number of new truck deliveries generated by the Project.

5.0 BUILDING CHARACTER

The Smith Research Laboratories will fill a gap in the existing building fabric and anchor the corner of Deaconess Road and Binney Street. The Project has been designed to bring greater physical and visual coherence to the area, providing a recognizable architectural identity for the Dana-Farber Cancer Institute. In its siting, massing and use of materials, the Project will help unify the buildings on the Dana-Farber campus and, although not directly on it, will help define the block from Brookline Avenue (see Figure IV.5-1).

The elevational character of the Smith Research Laboratories expresses a direct response to the program. The central laboratory bay on each facade is clad in stone with regular punched recessed openings, showing the disciplined rhythm of the laboratory module, while the corner office suites are articulated and clad in glassy curtain wall. The cornice and the cutaway of the corners at the top of the building animate the roof line, while the expression of fume hood exhaust stacks on the roof as symbols of laboratory research should lend a powerful heraldic element to the LMA skyline.

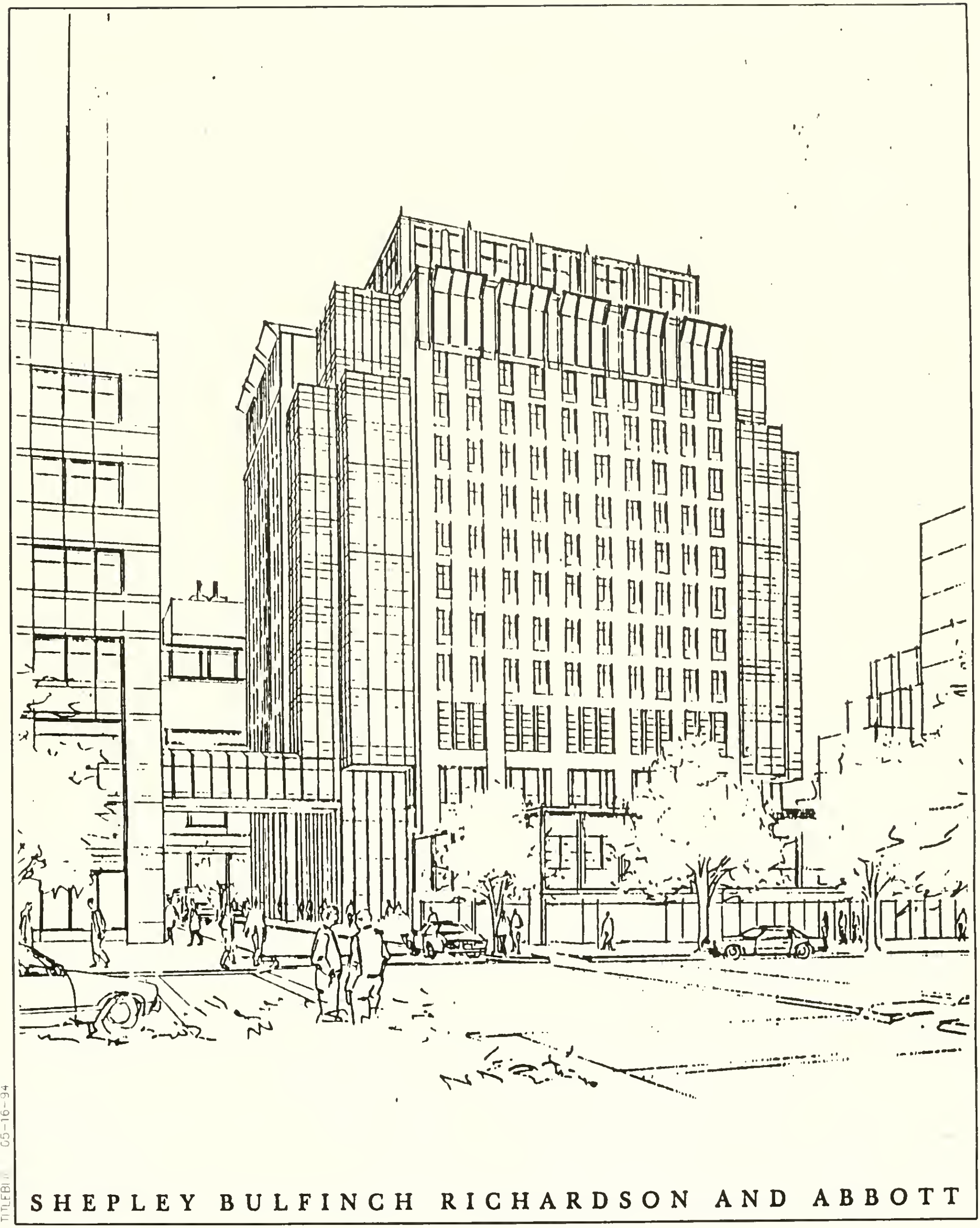


FIGURE VI.5-1
PERSPECTIVE FROM BROOKLINE AVENUE
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

VII. HISTORIC RESOURCES COMPONENT

DANA-FARBER
CANCER INSTITUTE

VII. HISTORIC RESOURCES COMPONENT

No outstanding issues concerning impacts to historic resources were identified in the BRA's PAD or the Secretary's Certificate. As described in the DPIR/DEIR, an inventory of historic resources in the Project area was conducted to determine whether the Project will have any adverse effect on these resources. This chapter summarizes the findings previously presented in the DPIR/DEIR and also includes information on the Olmsted Park System, which was not included in the previous report.

No known archaeological sites were identified within one-half mile of the project site. Historically significant buildings were identified and are discussed below.

1.0 INVENTORY OF HISTORIC PROPERTIES IN THE PROJECT AREA

A review of the Boston Landmark Commission (BLC) and Massachusetts Historical Commission (MHC) files was conducted to identify noteworthy buildings or sites in the Project vicinity. Figure VII.1-1 identifies the location of the properties. The significance of these buildings or sites is summarized below.

1.1 National Register Properties

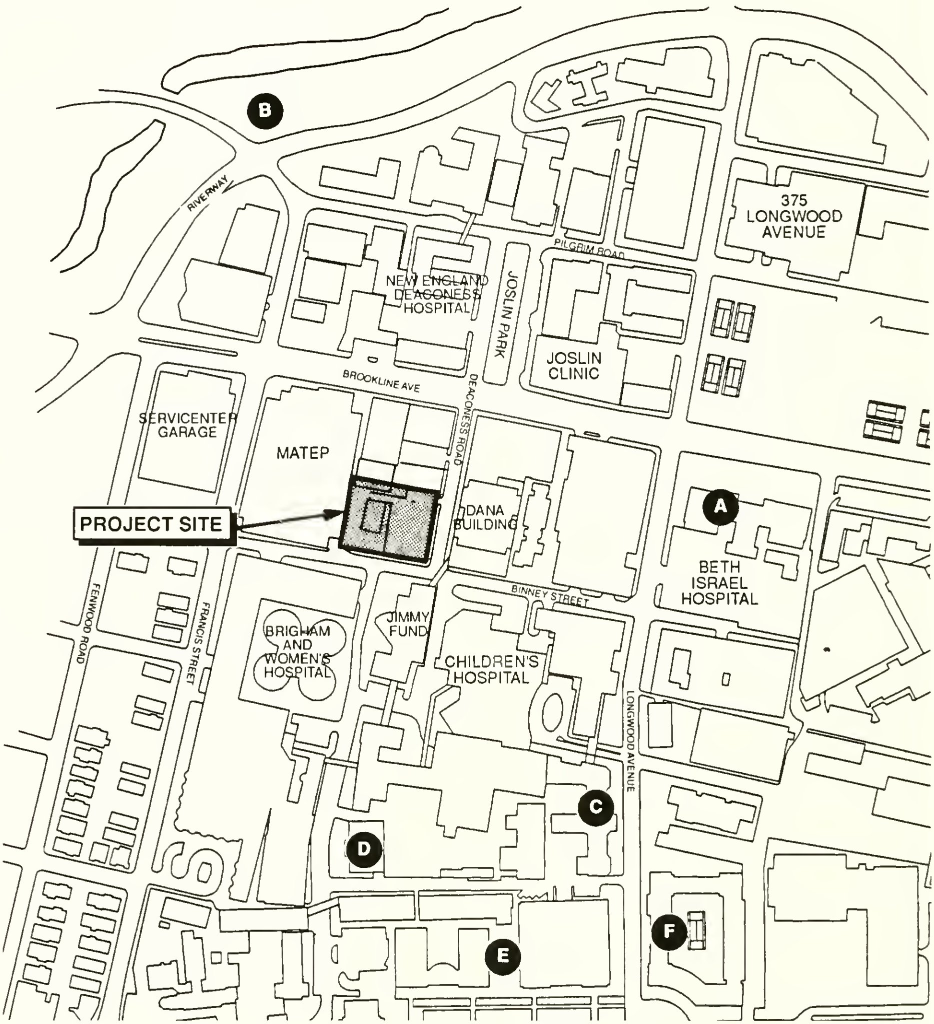
A. Massachusetts College of Art - 364 Brookline Avenue

The Massachusetts College of Art building, designed by architects Henry and Richmond, was built from 1929 to 1930. The exterior of the building is a mix of styles that include a blend of Art Deco and Modern Gothic architectural elements. The building is not considered a unique piece of architecture but rather a conglomerate of different styles with a large degree of applied decorative architectural detailing.

The Massachusetts College of Art building's historic significance is due primarily to its association with the history and goals of the school of art. The college is currently part of the Beth Israel Hospital Campus and has been incorporated as part of a larger hospital expansion project.

B. Olmsted Park System

The Olmsted Park System is part of Boston's famous "Emerald Necklace," a series of greenways and parks designed by Frederick Law Olmsted between 1879 and 1892. The park system includes a series of



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NOTE:
Letter designations correspond to descriptions in Section 1.0.

FIGURE VII.1-1
HISTORIC PROPERTIES NEAR THE PROJECT SITE
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

parks linked by continuous parkways. It begins at the mouth of the Muddy River and runs to Franklin Park in Roxbury.

Although many of the structures in the Olmsted Park System are in need of repair, Olmsted Park today remains intact and close to its original design. The Olmsted Park System, listed on the National Register of Historic Places, is one of the nation's finest examples of a multi-use open space and the landscape architect's best design project in New England.

Two sections of Olmsted Park run near the Project site: the Riverway (also known as Riverway Park) and the Muddy River. The Riverway is the name of a linear park connecting the Fens and Jamaica Pond, through which the Muddy River flows. The Riverway is three blocks southwest of the Project site.

1.2 Other Historic Properties

The Boston Landmarks Commission surveyed the LMA in 1983-1984. Survey forms for a number of properties within the vicinity of the project site were completed. A survey form was filled out if the site was notable for its architecture and for its local cultural and/or historical significance. The significance of the sites as described on these survey forms is briefly summarized below.

C. Children's Hospital - 300 Longwood Avenue

The original Children's Hospital, built in 1912, is a noteworthy example of Classical Revival institutional architecture. The Children's Hospital has significance as the third pediatric hospital established in America which has since achieved national prominence. It was incorporated in 1869 by Chandler Robbins, George H. Kuhn and Nathaniel H. Emmons. Nathaniel Thayer was the first president. Objectives outlined in the bylaws were the medical and surgical treatment of sick children; instruction in the diseases of children; and instruction of young women in the duties of nurses and nursery maids.

D. Rotch Memorial Hospital - 55 Shattuck Street

The Thomas Morgan Rotch, Jr. Memorial Hospital for Infants was designed by Shepley, Rutan and Coolidge and built in 1910. The building is a fine example of Classical Revival architecture by one of Boston's most prominent architectural firms, who were responsible for several buildings in the Longwood Medical Area. The building is a white marble-clad structure with a monumental Ionic portico and was

designed to coordinate with the adjacent Harvard Medical School buildings.

E. Harvard School of Dental Medicine and Harvard School of Medicine

The Harvard School of Dental Medicine and the Harvard School of Medicine were built from 1903 to 1908 in the Classical Revival style. Also designed by Shepley, Rutan Coolidge, the Harvard Medical School strongly influenced the establishment of the Longwood Medical Area as home to many of Boston's medical facilities. These buildings also strongly influenced the architectural style of other buildings that have been constructed in the area since that time.

F. Vanderbilt Halls

Built in 1926, this is an architecturally interesting dormitory building, distinctive for its Mediterranean-inspired style which is seldom seen in Boston. The building was designed by Coolidge, Shepley, Bulfinch and Abbott. Vanderbilt Hall's plan is dominantly rectangular with the exception of the southeast portion which has a concave exterior that follows the half circle at Avenue Louis Pasteur and Longwood Avenue.

2.0 EFFECTS OF THE PROJECT ON HISTORIC RESOURCES

All of the buildings immediately surrounding the site are relatively modern structures, constructed in varied architectural styles. As discussed in detail in Chapter VI (Urban Design), the Smith Research Laboratories will be compatible with nearby structures. The Project is designed to relate to and be compatible with the surrounding LMA structures in its height, scale and massing.

There are no historic resources adjacent to the Project site. The nearest historic structures are the old Massachusetts College of Art building at the corner of Brookline Avenue and Longwood Avenue, which is currently part of Beth Israel Hospital and undergoing expansion, and the Rotch Memorial Hospital at 55 Shattuck Street. These buildings are about two blocks away from the Project site. None of the historic resources are near enough to the Project so as to be affected by it.

In addition, shadow studies performed for the Project show that the Smith Research Laboratories will not impact the historic properties identified.

VIII. INFRASTRUCTURE SYSTEMS COMPONENT

DANA-FARBER
CANCER INSTITUTE

VIII. INFRASTRUCTURE SYSTEMS COMPONENT

The BRA's PAD stated that information on background projects (New England Deaconess Hospital and Joslin Diabetes Center) should be included in the infrastructure analysis and that the Project demands should be presented in terms of available capacity. Additional information on the MATEP facility was also requested. This information is included in this Chapter. The graphic figures showing the water and sewer system surrounding the site have been revised slightly and are included in this Chapter.

No additional information was requested in the Secretary's Certificate.

1.0 WATER DISTRIBUTION SYSTEM

1.1 Description of Existing Facilities

The Boston Water and Sewer Commission (BWSC) water distribution system in the Project area is shown in Figure VIII.1-1. Adjacent to the site, a 6-inch water main, built in 1951, is located in Deaconess Road. An 8-inch main exists at Binney Street. This main was built in 1957. Both of these mains connect to 12-inch mains, in Brookline Avenue and Francis Street, respectively.

Hydrant tests (Table VIII.1-1) in the vicinity of the Project site indicate that available system capacity ranges between 2,285 gpm and 2,889 gpm for the low pressure system, with residual pressure ranging from 33 psi to 49 psi, based on actual measurements. The minimum residual pressure considered adequate for fire fighting purposes (peak requirements) is 20 psi. Table VIII.1-1 shows that the calculated system capacity at a residual pressure of 20 psi ranges from 3,748 gpm to 6,605 gpm.

1.2 Project Water Demand

Water demand for the Smith Research Laboratories is estimated to average approximately 55,500 gallons per day (gpd) or 39 gallons per minute (gpm). The peak flow rate for the research facility is estimated to be 117 gpm based on a peaking factor of 3.

The refrigeration plant to be operated by MATEP will serve the needs of the Smith Research Laboratories, other Dana-Farber buildings and LMA needs. The plant capacity will be approximately 4,000 tons. Currently, plans are to operate the chiller plant as a peaking facility, operating only during the

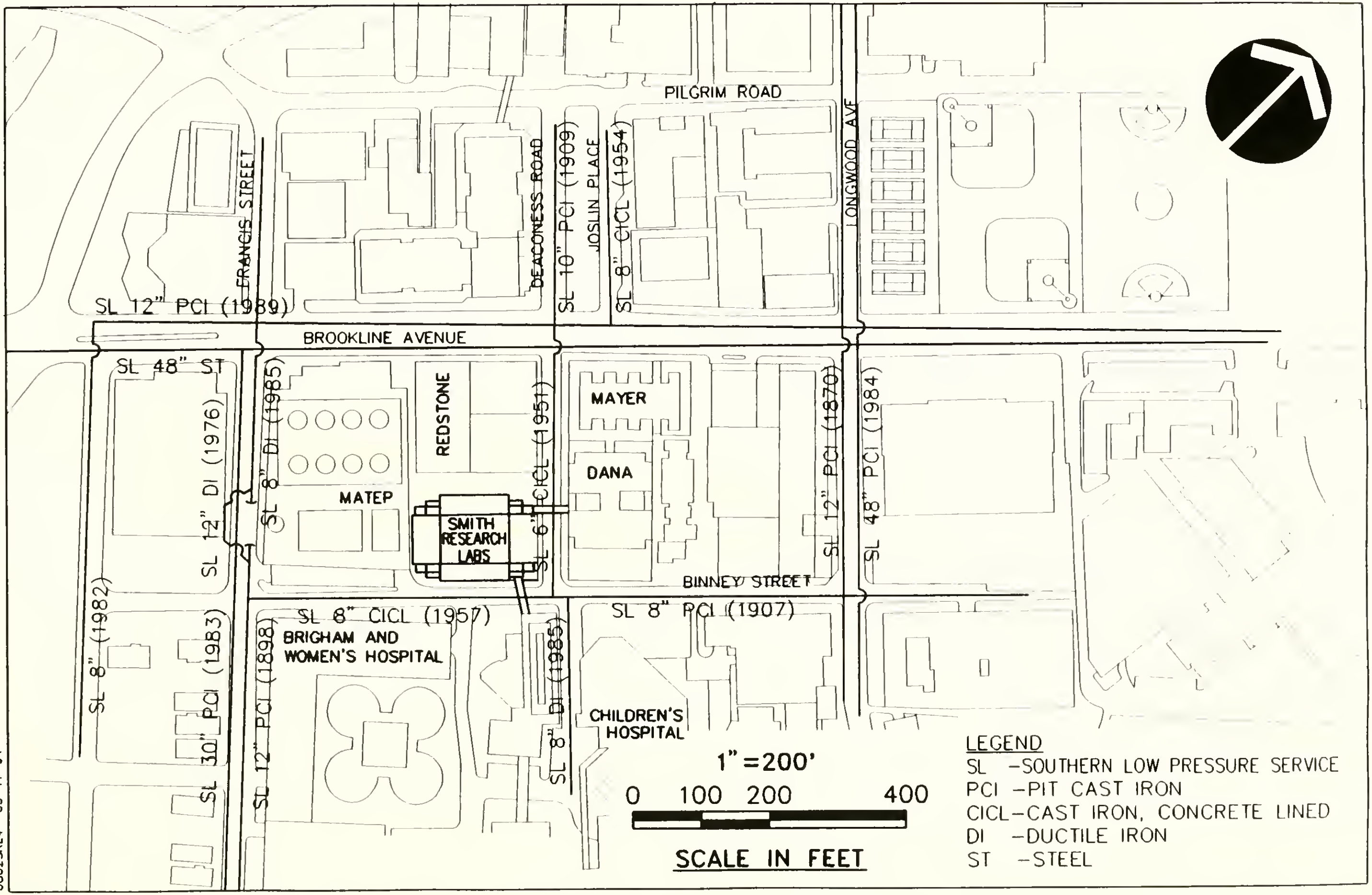

FIGURE VIII.1-1
WATER SUPPLY SYSTEM
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

Table VIII.1-1: Hydrant Flow Tests

Hydrant Test Location	Test Date	Static Pressure	Measured Flow at Residual Pressure	Calculated Flow at 20 psi Residual Pressure
Francis/Brookline 12" LS	11/87	57 psi	2,889 gpm @ 49 psi	6,605 gpm
Pilgrim/Longwood 12" LS	9/87	52 psi	2,837 gpm @ 33 psi	3,759 gpm
Vining/Fenwood 8" LS	1/90	58 psi	2,408 gpm @ 46 psi	4,487 gpm
Fenwood/Brookline 8" LS	1/90	55 psi	2,285 gpm @ 41 psi	3,748 gpm

Source: Boston Water and Sewer Commission

warmer two months of the year (July and August). The plant's peak water consumption, based on a 4,000-ton capacity, is estimated at 158,200 gpd (110 gpm).

1.3 Impact on Water Distribution System

Based on the above information, the peak water requirements for the Project are 227 gpm, which would occur when the refrigeration plant is in operation. Other projects in the area include the New England Deaconess Hospital Clinical Facility and the Joslin Diabetes Center expansion, both currently under construction, and the Deaconess Research Facility. Information obtained from previous submittals for these projects*, shows an additional demand of approximately 245 gpm attributed to other projects in the immediate area. Based on recent hydrant test data in Table VIII.1-1 for the Project vicinity, sufficient system capacity is available for the Dana-Farber and other projects. No system problems in the area have been identified by the BWSC.

* NEDH Research Facility FPIR/FEIR, February 1994.
NEDH Clinical Facility ENF, September 1987.
Joslin Diabetes Center Research and Clinic Facility Expansion ENF, 1990.

2.0 SANITARY SEWER SYSTEM

2.1 Description of Existing Facilities

The site is currently served by separate BWSC sanitary and storm water sewers which discharge to the Deer Island Treatment Plant and the Muddy River, respectively. Figure VIII.2-1 shows the routing of sanitary and storm wastewater from the site to a main interceptor (Brookline Interceptor).

There are two sanitary sewer lines adjacent to the site. Deaconess Road has a 10-inch sewer line and Binney Street has a 12-inch line. The sewers combine at manhole 118 under the intersection of Francis Street and Brookline Avenue.

The results of an evaluation of the capacity of the existing sewer facilities serving the site are shown on Table VIII.2-1. The capacity of each sewer segment has been calculated based on the Manning Equation and sewer sizes, manhole invert elevations, and segment length data taken from the BWSC Wastewater System Maps.

2.2 Impacts of Project on Sewer System

The majority of wastewater generated by the Project will be associated with domestic uses and the research laboratory. Sanitary sewage generation for the Smith Research Laboratories is estimated to be approximately 49,950 gpd, based on a 10% reduction of the water consumption estimates calculated for the Project. It is estimated that cooling tower blowdown will average an additional 25,000 gpd on an annual basis. The average blowdown during a peak month will be approximately 60,000 gpd. It is anticipated that the plant will be operated to meet only peak requirements during July and August. If so, the cooling tower system use will be restricted during the spring, fall and winter months, and blowdown discharge to the sewer would not occur.

The Project's peak wastewater demand is estimated to be 109,950 gpd (0.11 mgd). Data obtained for other projects which would use the same sewer segments as Dana-Farber (see Section 1.3 for projects) show that there may be an additional demand of 0.21 mgd on the system, resulting in a total additional demand of 0.32 mgd over the next few years.

The short segments, 95-CZ96 and CZ96-CZ97, operate under pressure. The manhole covers in the segments are water-tight concrete plugs. As a result, the limiting segment in terms of capacity appears to be CZ97-166 (segment under the Muddy River which then connects to the Brookline Interceptor Sewer). This segment has a calculated capacity of 4.64 mgd. Although

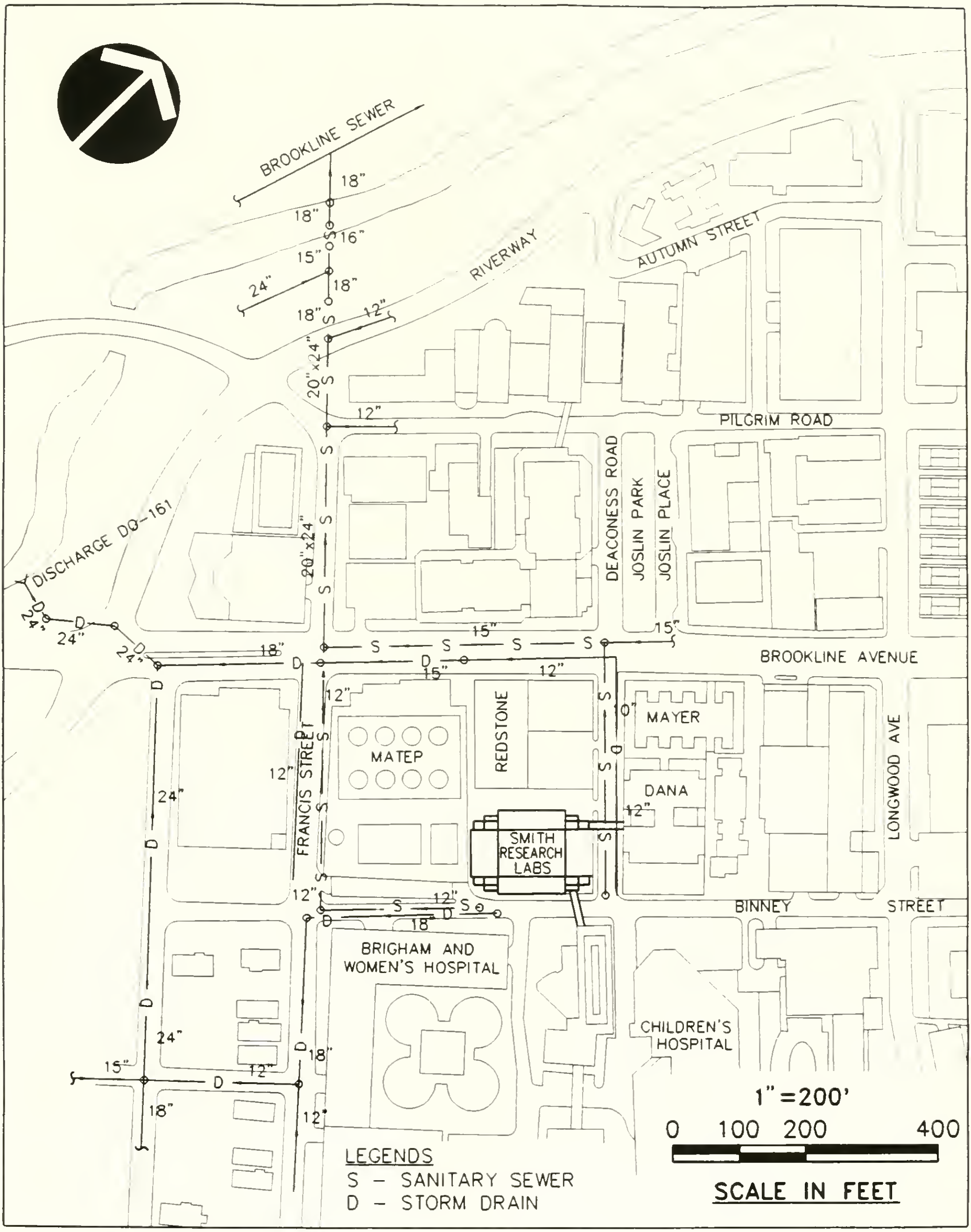

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FIGURE VIII.2-1
SEWER OUTLAY
SMITH RESEARCH LABORATORIES

HMM Associates, Inc.
A Summit Company

Table VIII.2-1: Sanitary Sewer Capacity

Manhole	Invert	Manhole	Invert	Pipe Diameter (in)	Length (ft)	Capacity (mgd)	Location
143	29.66	170	30.24	12	190	1.11	Binney Street
170	30.24	135	28.01	12	45	3.83	Francis Street
135	28.01	118	21.20	12	390	2.64	Francis Street
128	33.50	121	25.79	10	350	4.08	Deaconess Road
121	25.79	118	21.20	15	435	9.29	Brookline Avenue
118	21.20	101	19.60	20 x 24	355	10.09	Francis Street
101	19.60	100	19.00	20 x 24	130	10.21	Francis/Riverway
100	19.00	95	5.97	18	130	18.68	Riverway
95	5.97	CZ96	5.83	15	35	2.29	Muddy River
CZ96	5.83	CZ97	5.64	16	50	2.66	Muddy River
CZ97	5.64	166	5.30	18	55	4.64	Riverway (Brookline)
166	5.30	Brookline Sewer (167)	4.40	18	70	6.69	Riverway (Brookline)

Source: Boston Water and Sewer Commission Maps 20G and 21G.

records on the current demands on the system are not regularly maintained, the BWSC has stated that no overflow problems have occurred in the area. BWSC has indicated that no surcharge or overflow problems currently are observed in the sewer line evaluated, and there appears to be sufficient available capacity in the system.*

* Telephone conversation with BWSC, May 10, 1994.

3.0 MATEP CHILLED WATER CAPACITY

MATEP currently experiences chilled water capacity constraints during the warmer months of the year. Without additional capacity, the Smith Research Laboratories would not be provided with sufficient chilled water to meet their needs. The 4,000 ton chiller proposed as part of this Project will primarily serve Dana-Farber's needs with some additional capacity available for MATEP's overall system.

MATEP's expected shortfall was documented in a letter to MEPA dated April 23, 1993 concerning replacement of MATEP's Chiller No. 3. With replacement of Chiller No. 3 by a new chiller, MATEP's chilled water capacity would increase to a maximum of approximately 27,000 tons. The new chiller was needed to address chilled water demands in the summer of 1995 and included projects that had been approved at the time of the letter, including Deaconess' Clinical Facility, Brigham and Women's Center for Women and Newborns, Beth Israel Hospital's Clinical Center and the Joslin Diabetes Center Research and Clinical Facility.

The replacement Chiller No. 3 represents the maximum limit of chilled water generation equipment that can be installed within the existing MATEP building. Thus, additional chilled water demand beyond that projected for 1995 requires servicing at off-site locations. Dana-Farber's planned 4,000-ton chilled water plant, although physically located on Dana-Farber property, will be operated by and linked to the MATEP distribution system. In summary, the chilled water plant will provide for the future needs of Dana-Farber as well as provide additional capacity to the MATEP system.

3.0 ELECTRICITY

Electrical requirements for the Project are estimated to be approximately 28,302,000 kilowatt hours per year. Electric power for the building will be provided from MATEP's 13.8 kV distribution grid. An approximately 7,000 kva service will be extended from a utility manhole located on Binney Street adjacent to the property. The transformers and service equipment will be located within the building in a dedicated room with direct access to the street.

MATEP has indicated that sufficient capacity exists through their distribution system to supply the needs of the medical area customers.

IX. RESPONSES TO COMMENTS ON THE DEIR/DPIR

DANA-FARBER
CANCER INSTITUTE

IX. RESPONSES TO COMMENTS ON THE DPIR/DEIR

The following list includes the Certificate on the DEIR, the BRA's Preliminary Adequacy Determination, and comment letters received on the Draft Project Impact Report/Draft Environmental Impact Report (DPIR/DEIR).

1.0 Certificate of the Secretary of Environmental Affairs on the DEIR, December 16, 1993

2.0 Boston Redevelopment Authority, Preliminary Adequacy Determination on the DPIR, May 2, 1994

3.0 City of Boston Environment Department, December 3, 1993

4.0 Boston Water and Sewer Commission, December 8, 1993

5.0 Department of Environmental Protection, December 8. 1993

6.0 Boston Redevelopment Authority, December 2, 1993

7.0 Massachusetts Bay Transportation Authority, December 9, 1993

1.0 CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE DEIR

Received From: Trudy Coxe, Secretary

Date: December 6, 1993

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

WILLIAM F. WELD
GOVERNOR

ARGEO PAUL CELLUCCI
LIEUTENANT GOVERNOR

TRUDY COXE
SECRETARY

Tel (617) 727-9800
Fax (617) 727-2754

December 16, 1993

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Dana-Farber Cancer Institute New Research Building
PROJECT LOCATION	: Boston
EOEA NUMBER	: 9452
PROJECT PROPONENT	: Dana-Farber Cancer Institute
DATE NOTICED IN MONITOR	: November 7, 1993

The Secretary of Environmental Affairs herein issues a statement that the Draft Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L., c. 30, s. 61-62H) and with its implementing regulations (301 CMR 11.00).

Dana-Farber proposes to construct a new research building at 65 Deaconess Road in the Longwood Medical Area (LMA) of Boston. The project will add 290,000 gross square feet in 14 stories and a 261 space below grade garage. The project site is 28,845 square feet and is currently occupied by a small 3-story building and a 58 car surface parking lot. The Longwood Medical Area is a 175 acre area within the City of Boston roughly bounded by Huntington Avenue, the Fenway and the Riverway. The project will also house space for research for Brigham and Women's Hospital, which is nearby. There is a proposed bridge on the third level that will link the project to Brigham and Women's Hospital. The project is estimated to have 420 new employees.

This document is a joint Environmental Impact Report/Project Impact Report (EIR/PIR), and a Determination of Adequacy is expected shortly from the Boston Redevelopment Authority (BRA). In addition, the Draft EIR/PIR states that Dana-Farber submitted a draft Institutional Master Plan to the BRA on August 4, with revision on September 24, 1993. In the main, the DEIR/PIR under review herein adequately responds to the Certificate on the Environmental Notification Form that was issued by this office.

The Final EIR/PIR should resolve the remaining issues, as outlined below, as well as issues to be outlined in the BRA's upcoming Determination of Adequacy. It should also address the comments received on the DEIR/PIR.

As noted in my November 1, 1993 Certificate on the Draft Environmental Impact Report for the Harvard Institutes of Medicine, EOEA #9428, the Longwood Medical Area has continued to grow, despite the economy. The list of new projects in the LMA is extensive, totalling approximately 2.2 million square feet in the next five years, exclusive of the Dana-Farber New Research Building. Although the incremental impacts of each new development appear to be manageable, these developments combined will contribute significantly to traffic congestion and air pollution. It is clear that, given the traffic growth forecasts for this area, there is a need for transportation systems improvements that could be far reaching. These large scale improvements are beyond the scope of the impacts from the Dana-Farber project alone. Short range improvements commensurate with an individual project's impacts should be the responsibility of individual proponents to ensure that further deterioration of poor traffic conditions is avoided.

The remainder of this Certificate will focus on the DEIR analysis and issues to be resolved and considered in the FEIR. These issues relate primarily to traffic and transportation.

General

The DEIR/PIR does a good job describing the visual impacts, wind impacts, air quality impacts, water and sewer impacts, shadow impacts and impacts on historic and parkland resources. I note that the shadow and wind impact studies are particularly well prepared, readable and understandable. The project does not negatively impact the Riverway, which is an historic resource and designated landmark. The FEIR/PIR should provide information on additional design changes that occur as a result of consultation with the City of Boston Environmental Department and the Boston Civic Design Commission. 1.1

I understand that there are ongoing efforts by the City of Boston to prepare an overall plan for the entire Longwood Medical Area. The FEIR/PIR should provide an update on these activities, and 1.2
explain how the project fits into the larger context of the City's plan. In addition, the DEIR/PIR notes that the proponent prepared an Institutional Master Plan earlier this year. The FEIR/PIR should discuss the relationship of this specific new 1.3

research building project with the overall Institutional Master Plan.

Traffic and Transportation

The DEIR/PIR shows that the level of service (LOS) in the LMA will continue to decline, in some cases to unacceptable levels of E and below. Although the report demonstrates that this decline is not due exclusively to Dana-Farber, the EIR does not describe or commit to adequate mitigation to address the incremental impacts related to the project. For example, the only roadway mitigation discussed involves cooperating with MASCO in its ongoing efforts to improve signal timing and traffic operations within the LMA. The DEIR/PIR notes that "such improvements could lead to improved LOS conditions at signalized intersections."
Unfortunately, the DEIR/PIR does not contain any analysis that 1.4
demonstrates what level of improvement might be expected from such adjustments. Such an analysis should be included in the FEIR/PIR. The FEIR should also contain a summary of the types of improvements that are being considered by MASCO so that there is a context for this discussion on roadway mitigation measures, as
well as other non-roadway mitigation measures, as noted below. 1.5

The FEIR should contain additional discussion and analysis of
particular locations, such as Brookline Avenue and Deaconess 1.6
Road, where levels of service are expected to fall to unacceptable levels in peak hours in the 1998 scenarios. Again, I note that such deterioration is expected to take place largely due to the scale of overall development in the area and not to any project taken individually. The FEIR should include a
discussion of the range of mitigation measures that could be 1.7
implemented to prevent further decline in the LOS and contain a discussion of Dana-Farber's role in appropriate components of this mitigation.

Particular attention should be paid to the concerns of the MBTA,
as expressed in its comments on the DEIR/PIR. The FEIR/PIR 1.8
should develop an analysis that examines average delay for vehicles traveling to and through the area on the main line roadways. For example, what is the effect on travel time for traffic on Brookline Ave, the main thoroughfare, in 1998 under the build and no-build scenarios? What mitigation measures can be implemented to reduce delay?

While the parking management plan is generally headed in the right direction, improvements could be made to reduce the parking
demand. For example, Dana-Farber currently provides a 25% 1.9

transit subsidy to employees. The nearby Deaconess Hospital plans to offer 50% transit subsidies by 1998. Consideration should be given to increasing this subsidy. I note that Section 4.2 of the DEIR/PIR summarizes the parking demand management reduction strategies. Notably missing are management reduction incentives that involve adjusting the cost of either on-campus or off-campus parking rates. The FEIR/PIR should consider the 1.10 impact on demand of adjustments in parking fees. The proponent is encouraged to discuss pricing strategies with the City of Boston Air Pollution Control Commission. The price of parking should be an integral part of a parking demand strategy.

The FEIR should contain a summary of mode splits found at other institutions in the LMA (see DEIR for Harvard Institutes of Medicine, Table III-14 and 15, EOEA #9428). Mode splits at Dana-Farber should be compared to these averages, particularly with respect to employees, rather than visitors. 1.11

The trip generation estimates for this project were given for the AM and PM peak hours based on ITE standard rates in addition to rates developed based on project specific data. Page IV-32 notes that the institution specific data (shown as net new vehicle trips) included deductions of estimated trips based on mode split and vehicle occupancy. The FEIR should clarify whether the trip rates were generated based on square footage or number of employees. The differences between the results should be discussed if the number of employees, rather than square footage, was used for estimating trips. The FEIR/PIR should also contain the average daily trip (ADT) estimates. 1.12

EIRs for other projects have estimated trip generation in similar ways using institution specific data. The FEIR/PIR should 1.13 consider the consistency of trip rates between institutions in the LMA and discuss whether an LMA trip rate that is more universally used for such estimates should be developed for future studies.

The DEIR/PIR did a good job describing the potential environmental impacts of this proposed project. The goal of the 1.14 FEIR/PIR should be to consider ways to achieve higher non-vehicle trip rates and develop a mechanism for monitoring and maintaining these results after project is operational.

Conclusion

I commend the proponent for preparing a responsive and comprehensive environmental document. I look forward to reviewing the Final EIR/PIR. I continue to have concerns about the impact of cumulative development on the Longwood Medical Area. I am pleased that the City is undertaking a comprehensive planning effort for the area. It would be beneficial, I believe, to involve the proponents of the current development proposals, MASCO, the local and state environmental and transportation agencies and other interested parties in a dialogue about long range infrastructure needs and goals for the area. I strongly **1.15** recommend that a meeting be organized in the near future to discuss the possibility of accelerating the planning process with such additional input.

December 16, 1993
Date

TRUDY COXE
Trudy Coxe

Comments received:
City of Boston Environment Department
Boston Water and Sewer Commission
DEP Air Quality
MBTA
BRA

P:DEIR9452

TC/JD/jd

1.1 Information on Additional Design Changes

The Smith Research Laboratories Project has undergone considerable change since the filing of the DPIR/DEIR in October 1993. Following consultation with the Boston Redevelopment Authority, the Boston Civic Design Commission and the Mission Hill PZAC, changes were made in the Project's build-out (square footage), height, massing and connecting overhead bridges. Specific project description and urban design changes are discussed in Chapters III and IV of this FPIR/FEIR.

1.2 Update on How Dana-Farber Project Fits into the City of Boston Plan for the LMA

The Dana-Farber Cancer Institute is an active participant in City-sponsored master planning for the Longwood Medical Area. This effort, being directed by the Boston Redevelopment Authority in coordination with LMA institutional representatives, MASCO and residential community participants from nearby Fenway and Mission Hill, is scheduled for completion in calendar year 1994. The BRA has reviewed the proposed Smith Research Laboratories as it relates to the current LMA planning effort. The Project is consistent with general principles guiding this study, including the mitigation of negative impacts on the City's existing housing stock or on existing park land or open space resources. It also consolidates existing inefficient uses into one facility and provides for joint use of space with another nearby institution which are objectives of the City's planning program.

The Smith Research Laboratories Project is being planned at the same time that the New England Deaconess Hospital is proposing a Research Facility (EOEA #8776) on the other side of Brookline Avenue, and Harvard Institutes of Medicine is proposing the conversion of the former English High School to a Research Facility (EOEA #9428). These projects and the Dana-Farber Project demonstrate the importance of new research to the survival and leadership of these institutions in their key research areas. Research supports not only medical education but clinical excellence, a critical aspect of all of these Harvard teaching facilities.

The Deaconess and Harvard projects have completed their environmental reviews. The construction planning of both of these projects will be coordinated with the Dana-Farber Project to minimize street occupancy and traffic disruption through the Transportation Access Plan and Traffic Maintenance Plan Agreements with the City, required for each project. MASCO's LMA Transportation Study, updated in 1992, continues to be used as a framework for implementing access improvements within the LMA (see Appendix D letter to Dana-Farber from MASCO, for listing of these improvements).

1.3 Update on How Project Fits into overall Institutional Master Plan

The Smith Research Laboratories Project is Dana-Farber's single most important Master Plan project that the Institute will complete over the 8-10 year Master Plan period. This

Project is described in the Institute's Master Plan which was approved by the Boston Redevelopment Authority on March 10, 1994, and by the Boston Zoning Commission on March 29, 1994 (in conjunction with the Commission's adoption of an institutional district for the Dana-Farber Campus). Research which will be the focus of the Smith Research Laboratories is at the foundation of all Dana-Farber activities which attempt to relate patient care with major advances in research.

1.4 Level of LOS Improvement to be Expected at Signalized Intersections

The Institute is cooperating with MASCO and Boston Transportation Department in their ongoing efforts to improve signal timing and traffic improvements within the LMA. It is expected that MASCO will initiate an analysis this year to determine what conceptual improvement scheme, including new signal timing, would be possible at the Brookline Avenue/Riverway intersection. In addition, Dana Farber has investigated possible signal timing and phasing improvements with the City for the Deaconess Road/Brookline Avenue intersection. While such an improvement has the potential to improve AM peak hour LOS from F to B, such an improvement does not necessarily address the need for reducing delays along the entire length of Brookline Avenue between the Riverway and Longwood Avenue. Therefore, Dana-Farber has agreed to contribute $45,000 to the City of Boston for signal upgrading and overall coordination of timing along Brookline Avenue from Riverway to Longwood Avenue which includes the Deaconess Road intersection.

1.5 Summary of Types of Improvements Being Considered by MASCO

An update of MASCO's list of priority transportation improvements is contained in Appendix D, in a letter to Dana-Farber from MASCO which attaches the list. Dana-Farber, as an active member of MASCO, contributes a proportionate share to MASCO operations which include LMA improvement projects sponsored by MASCO.

1.6 Additional Analysis of Brookline Avenue/Deaconess Road

See Response to Comment 1.4.

1.7 Discussion of Mitigation Measures

See Response to Comment 1.5.

1.8 Analysis of Delay for Vehicles Traveling on Main Roadways

With the improvements to existing signal timing and coordination as discussed in Comment 1.4, delays along Brookline Avenue will be decreased.

1.9 Transit Subsidy to Employees

Transit subsidies provided by medical facilities within the LMA average approximately 25% of the cost of a T-Pass. CommuteWorks, the LMA's Transportation Management Association (TMA) which Dana-Farber helps to fund and of which it is an active member, provides a number of services including: computerized rideshare matching; full-time transportation coordinator; a full service transportation store (The Ticket Office) located at the Longwood Galleria where employees and patients can purchase MBTA tokens and visitors passes as well as receive commuting information assistance; free vanpool parking; auxiliary parking for those employees who rideshare but need to use their cars up to five times per month; annual transportation events such as BIKE LMA '94 and MASCO's FREE VANPOOL RIDE offered this year; other marketing efforts to promote commuting alternatives; membership in the Boston Transportation Management Council (BTMC); and new vanpool initiatives. An example of a new vanpool initiative is MASCO's successful application to the State's TMA Assistance Program, for funds to support aggressive formation of new vanpools. Within the past four months, since receiving State assistance, MASCO has established two new vanpools with the expectation that these and two more will be created and fully subscribed in eight months. As indicated in MASCO's letter contained in Appendix D, the LMA's ability to maintain a stable transit share in the past ten years compared to the city-wide transit share decline, is an example of MASCO's efforts to reduce the number of single passenger vehicles coming to the LMA. It should also be noted that Dana-Farber was the first institution in the LMA to offer a vanpool subsidy to its employees.

1.10 Adjustment of Parking Rates as Part of Parking Demand Strategy

A Transportation Access Plan (TAP) Agreement is currently being negotiated by Dana-Farber with the Boston Transportation Department. This Agreement includes commitments to maintaining a parking rate differential on-campus versus remote parking lots as a means of managing parking demand within the LMA. It should be noted that Dana's rates as described in the DPIR/DEIR, are within the range of other rates at LMA's medical institutions. In addition, Dana-Farber was one of the first institutions in the LMA to commit to locating employees in remote parking facilities.

1.11 Comparison of Mode Splits with Other Institutions

See Response to Comment 1.13 for comparison of the Smith Research Laboratories mode split with other LMA institutions.

1.12 Average Daily Trip Estimates

This information is contained in Chapter IV, Table IV.3-1.

1.13 *Comparison of Trip Generation Rates*

Trip generation for the Smith Research Laboratories was analyzed using ITE Land Use Code 760 which represents Research & Development (R&D) space. The analysis in the FPIR/FEIR applied the rates to the total square footage proposed for the building (267,000 s.f.) to present a conservative analysis. An option, which is shown in the following table, is to utilize the net number of new employees (420). As indicated, this would have reduced trips from 56% to 60%. While the lower number may be more realistic and expected, use of the higher rates appear more consistent with MEPA Guidelines.

The DEIR for EOEA #9428 (Harvard Institutes of Medicine) conducted a similar analysis, as did the New England Deaconess Research Facility (EOEA #8776). The following table summarizes the number of new employees and the vehicle trips for the three projects.

Comparison of Vehicle Trip Generation

Project	# New Employees	AM Peak Enter	AM Peak Exit	PM Peak Enter	PM Peak Exit	Daily Trips
Dana-Farber Cancer Institute (EOEA #9452)[1]	420	160	33	28	154	1,345
Dana-Farber Cancer Institute (EOEA #9452)[2]	420	90	19	16	93	789
New England Deaconess Hospital Research Facility (EOEA #8776)[3]	75	15	0	0	8	44
New England Deaconess Hospital Research Facility (EOEA #8776)[4]	75	25	5	5	26	209
Harvard Institutes of Medicine (EOEA #9428)[5]	745	82	8	10	52	910

1 ITE Land Use Code 760 for 267,000 gsf building adjusted for Modal Share.

2 ITE Land Use Code 760 adjusted for Modal Share by employees.

3 Based upon New England Deaconess Hospital specific data (75 new employees; 225 employees to be relocated from other research space owned or leased by New England Deaconess Hospital).

4 ITE Land Use Code 760 adjusted for Modal Share and Vehicle Occupancy.

5 Harvard Institutes of Medicine, Draft Environmental Impact Report (EOEA #9428), VHB, Inc., September, 1993.

1.14 Achieving Higher Non-Vehicle Trip Rates

The Dana-Farber Transportation Access Plan (TAP) Agreement with the City of Boston will outline significant strategies and commitments to be established by the Institute in order to achieve higher non-vehicle trip rates, and improved transportation demand management reduction measures. The TAP Agreement will also require annual monitoring to maintain targets after Project occupancy.

1.15 Accelerating the Planning process for Implementing Long-Range Area-wide Infrastructure Needs and Goals

MASCO, as the overall transportation coordinating organization for LMA's institutions, has actively been working on behalf of all the LMA institutions to develop a set of transportation initiatives including regional serving circumferential transit improvements, outside LMA/remote parking facilities, a new and better coordinated MASCO bus service, and improved and coordinated infrastructure improvements in the LMA (see Appendix D, letter from MASCO, for additional discussion of long-range area-wide infrastructure needs and goals).

2.0 BOSTON REDEVELOPMENT AUTHORITY, PRELIMINARY ADEQUACY DETERMINATION ON THE DPIR

Received From:	Beverley Johnson, Former Assistant Director for Institutional Planning and Development
Date:	May 2, 1994

Boston
Redevelopment
Authority

2 May 1994

Mr. John W. Pettit
Chief Administrative Officer
Dana-Farber Cancer Institute
44 Binney Street
Boston, MA 02115

Dear Mr. Pettit:

Re: Dana-Farber Cancer Institute New Research Building: Preliminary Adequacy Determination

This letter is the Preliminary Adequacy Determination (the "Determination") of the Boston Redevelopment Authority (BRA) with respect to the Draft Project Impact Report (DPIR) submitted by Dana-Farber Cancer Institute regarding the New Research Building (the "Proposed Project").

The Proposed Project is being reviewed pursuant to Section 31-5 of the Boston Zoning Code. The BRA is issuing the Determination which requests additional information required by the BRA in order to proceed with the review of the Proposed Project. The Technical Appendix attached to this letter identifies specific areas of concern and requests preparation of additional information and investigation of additional mitigation measures. Apart from these issues, the balance of the DPIR submitted is sufficient to satisfy the scoping requirements.

Article 31 of the Code sets out a comprehensive procedure for project review and requires the promulgation of an Adequacy Determination (AD) prior to the issuance of a building permit. The AD is issued upon determination by the BRA that the Final Project Impact Report provides satisfactory evidence that adequate mitigation strategies have been generated for all potential adverse impacts for the Proposed Project. We look forward to reviewing the Final Project Impact Report.

Sincerely,

Beverley E. Johnson

Beverley E. Johnson
Assistant Director for Institutional
Planning and Development

TECHNICAL APPENDIX

TO THE

PRELIMINARY ADEQUACY DETERMINATION

FOR

THE DANA-FARBER CANCER INSTITUTE

NEW RESEARCH BUILDING PROJECT

I. DEVELOPMENT REVIEW REQUIREMENTS - ARTICLE 31

Article 31 of the Boston Zoning Code promulgates a process by which large-scale development projects are reviewed by the Boston Redevelopment Authority (BRA) and the public to ensure that they enhance the public welfare. Subsequent to the submission of the DPIR the proponent generated urban design modifications based on public comments as well as recommendations from BRA staff and the Boston Civic Design Commission. The Project size has been reduced from 290,000 square feet to a floor area of 213,592 square feet, a height of 184 feet and contains 13 floors above grade. In its review of the DPIR in light of the modified Project and the public comments which were received, the BRA has identified a number of project issues which will require additional analysis and clarification. The proponent must adequately respond to the issues that are raised herein in its submission of the Final Project Impact Report (FPIR) in order for the BRA to find the project mitigation measures satisfactory and issue a Final Adequacy Determination (FAD). The following is a description of the BRA's review of the DPIR and the additional information which must be included in the FPIR.

A. General Information

The following additional general information is requested.

The financial information presented fails to describe the terms of the participation of Brigham and Women's Hospital in the project. 2.1

The amounts estimated for linkage contributions and the PILOT needs to be stated in the FPIR. 2.2

The discussion of employment and training benefits does not adequately describe the Institute's commitment and efforts to target such benefits to Mission Hill and Boston residents. 2.3
An analysis of the existing institute workforce, which identifies the 2.4

percentage of Boston and Mission Hill residents by job and salary category needs to be presented as the basis for designing programs to enhance community benefits.

The description of community services provided by the Institute, wherever possible, should clarify what Boston based organizations benefit and in what way. 2.5

B. Transportation Component

The review of the DPIR by the Boston Transportation Department follows.

Traffic/Trip Generation. Section 3.1 states that ITE rates, adjusted by mode split assumptions, were used to calculate vehicle trip generation. If, as indicated in Table 4-1, the number of new employees is known, that number should have been used as the basis for trip generation factors; or, in any case, some discussion should have been presented of the relationship between full-time day employees and peak hour trips. 2.6

The intersection analysis indicates that the level of service at the Deaconess/Brookline intersection deteriorates from a C to an F, with over two minutes of delay, between the no-build and build condition. Specific mitigation needs to be offered in the FPIR which would prevent the failure of this important intersection. 2.7

Parking Supply. In terms of project design review, the most important issue is parking. The parking supply/demand relationships need to be carefully and correctly analyzed. The DPIR contains a number of errors and inconsistencies which require clarification before a decision can be reached regarding the appropriate number of parking spaces in the development. 2.8

The scope calls for "A clear program... for the utilization of the proposed parking in the new facility as well as remaining spaces in the existing facility and other spaces owned, operated or used by" the Institute. No detail is provided of the utilization and allocation of parking in the future condition. Furthermore, the only discussion of future parking conditions (in the Mitigation section) refers to: (1) the Institute continuing to lease 218 spaces in the LMA, whereas Table 1-4 shows 16- spaces leased in the LMA; and (2) 326 off-site and nearby spaces, which would seem to correlate with the MASCO spaces cited in Section 1, whereas Section 1 identifies 362 such spaces. 2.9

The purpose of the parking analysis is to justify the proposed project's parking component, by placing new parking demand generated by the project in the context of existing supply and demand. The inconsistencies and omissions in the DPIR make it impossible to evaluate the number of parking spaces proposed. It does appear that the number is too large, since it would yield more than one new space for every two new employees, a ratio considerably higher than that for the LMA as a whole.

However, many spaces are in the Institute's total supply, patients and visitors must be accommodated, in adjacent, convenient facilities. Thus the analysis of patient/visitor parking demand is important. However, none is provided. Section 3.5 seems to state that the 138 spaces at the Dana Building are assumed to be sufficient for patient/visitor parking, but Table 1-4 shows an "assignment" of 160 patients/visitors at the site. The source of this number should be revealed, and the apparent shortfall addressed. 2.10

Mitigation. The general mitigation program is directed at minimizing overall vehicle-trip generation through a series of commuter mobility program measures. While these actions are appropriate, it is not clear either that they will have the effect predicted -- for example, the achievement of a 15% carpool share -- or what effect they will have on overall traffic conditions. 2.11

C. Environmental Protection Component

1. Wind

The wind impact assessment should be modified in light of the current project design. 2.12

For ease of reference, the existing and build condition figures should be placed on facing pages, not back-to-back (done for NW and SW winds, but not for the easterly winds).

Some of the building heights noted in the text do not match with the heights given in Fig. V.1-1 (e.g., Dana Building).

2. Shadow

The shadow studies should be refined based on the reduced project size. 2.13

The statement in the fifth paragraph of section 2.5 is incorrect, since Fig. V.2-12 clearly shows that Joslin Park will be affected by project shadows in the late mornings of winter. Joslin Park is impacted by shadows in December and possibly from October through February by shadows in the late morning until just after noon. Further, evaluations for 10:00 a.m., 11:00 a.m. and 12:00 Noon are recommended for October 21, November/January 21, December 21 (10 a.m., 11 a.m., 1 p.m., 2 p.m.), and February 21. Early afternoon studies on December 21 may reveal some impacts on the fields at Longwood and Brookline.

3. Daylight Analysis

The daylight analysis needs to be recalculated for the reduced project. 2.14

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4. Air Quality

For ease of reference, the receptor identification on the figures should also include the numerical designation given in Table V.4-1. Both figures and tables should have consistent identification. 2.15

What is the "Boston Fire Dept." receptor identified in Figure V.4.1? 2.16

The actual height of the MATEP stack should be given. Does it conform to the GEP stack height determined from the 1988 MATEP study?

A summary of the MATEP air quality data would be helpful for review of the potential stack effects. 2.17

5. Solid and Hazardous Wastes

The information presented satisfies the scoping requirement.

6. Noise

The receptor identification should be keyed to the numbers on Figure V.7-2. In addition, the height of the receptors should be given (ground level, elevated, etc.). 2.18

7. Geotechnical Impact

The impact of the permanent dewatering system on groundwater level maintenance in the adjacent areas should be evaluated. 2.19

8. Construction Impacts

Due to the several sensitive receptors in the area (hospital facilities), particular care will need to be exercised during the construction period to minimize as much as possible adverse impacts from excessive noise, dust and pollutant emissions, etc. The proximity to residences on Francis Street raises concern that construction hours may need to be restricted. 2.20

Table V.9-2 is identical with Table V.7-2 but shows a different date. Which is correct? 2.21

It is recommended that demolition and construction waste be recycled to the extent possible rather than be disposed of in scarce landfills. 2.22

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A truck route which does not use Francis Street needs to be identified. The residents of Francis Street and the Mission Hill PZAC have requested that Francis Street not be used as a truck route. 2.23

The Institute is encouraged to provide T-passes to construction workers to discourage parking in the area. 2.24

D. Urban Design Component

1. Scoping Determination Issues

The following issues raised in the Scoping Determination have been adequately addressed in the DPIR.

a. Project Location

The analysis of alternative sites indicated that it was not feasible to build the project on any other parcel owned by Dana-Farber because of the need to maintain continuous operation of facilities on the other parcels, to design a compact and efficient floor plate, to provide adjacency between clinical and research activities, and to accommodate parking in the proposed project.

b. Building Height and Bulk

The building bulk was reduced by 11% to 238,300 FAR square feet and the FAR was reduced from 10.2 to 8.3. The visual impact of the building mass was substantially modified through the design review process by stepping back the upper corners to taper the mass, by differentiating the materials of the middle of the building from those of the corners to emphasize slimmer proportions, and by articulating the top of the central bay below the penthouse levels to minimize apparent height.

c. Streetscapes

The size of the proposed pedestrian bridge above Deaconess Road was reduced from two- to one-story and its width from 100 feet to 10 feet. Both bridges are at least 22 feet above the street and are made primarily of transparent materials.

All of the Dana-Farber pedestrian areas, both proposed and existing, will be improved with new paving, tree-planting, street furniture, and lights, and views of adjacent service areas and parking ramps will be improved by introducing new walls and planters.

d. Building Character

The image of the building proposed in the PNF has been significantly modified. A stronger, better-proportioned masonry wall with punched openings has replaced the infilled frame design and a more deliberate expression of the penthouse and rooftop mechanical equipment will provide an improved skyline view.

2. Subsequent Issues

The following issues were raised in reviews by the Mission Hill PZAC and the Boston Civic Design Commission and have been adequately addressed in Schematic Design drawings dated January 7, March 1, and March 4, 1994.

a. Sidewalk Setback

The street-level building arcade was deleted and the sidewalk width increased from 6'-6" to 19'-6" to provide substantially more pedestrian circulation space and ambient light along Binney Street and a less abrupt change in scale along the sidewalk regarding the high building wall.

b. Garage Access

The ramps to basement parking levels were located within the building where they will be less noticeable than in their previous location alongside the building. Garage doors in the new location will also be used to conceal the ramps and improve the appearance.

c. Pedestrian Bridges

The public streetscape will be improved by the deletion of the existing pedestrian bridge connecting the Jimmy Fund and Dana Building at the second floor, crossing Binney Street diagonally. It will be replaced by the proposed bridges at the third floor, 24 feet above the street, transparent in design, and crossing the streets more comfortably at a right angle.

d. Building Height and Bulk

Project proponents have deleted one floor of research space from the program. This results in a reduction in building height of 10 feet to 184 feet and a reduction of FAR gross floor area from 238,000 to 214,000 square feet.

E. Historic Resources Component

The information presented satisfies the scoping requirement.

F. Infrastructure Systems Component

Inclusion of background projects as required by the scoping is not clear. Additionally, the project demands are not presented as percentages of available system capacities as requested. This is particularly critical in the LMA, which is evolving into a demand-intense densely developed area. For instance, the gpm peak requirements of water usage and chiller requirements are not given, but may add up to a significant percentage of available capacity - not including other projects in the area. The sewer system has the same limiting pipe segment as Deaconess and Joslin - but these projects are not referenced, nor is available capacity discussed. MATEP's chilled water capacity expansion via the plant proposed as part of this Project should be further discussed. It does not seem to be assisting, say, the Deaconess Research project proposal, which plans a similarly-sized plant (3,000 tons, downsized from 6,000) on the roof of an existing garage directly across from apartment buildings. 2.25

Although electricity appears to be in adequate supply, again, MATEP's demand/capacity relationship is not cited. 2.26

A 12-inch line in Deaconess Road is noted but is not shown on Fig. VIII.2-1 (2.5 Storm Water Drainage) 2.27

II. INSTITUTIONAL MASTER PLAN

The Institutional Master Plan has been modified to reflect comments received from BRA staff. 2.28

III. AGREEMENTS

In addition to completing the Article 31 Development Review and the Institutional Master Plan requirements, the agreements and plans listed below must be provided in form and content satisfactory to the relevant signatory public agencies before building permits shall be issued for the project. 2.29

A. Development Impact Project (DIP) Plan and Agreement including provisions for a Housing Contribution Grant and Jobs Contribution Grant pursuant to Articles 26A and 26B of the Code;

B. PDA Development Plan pursuant to Section 3-1A of the Code;

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C. Cooperation Agreement;

D. Transportation Access Plan (TAP) Agreement;

E. Traffic Maintenance Plan in conformity with the City's Construction Management Program;

F. Boston Residents Construction Employment Plan, pursuant to Chapter 12 of the Ordinances of 1986 of the City of Boston, as amended by Chapter 17 of said Ordinances, and Executive Order Extending Boston Residents Job Policy, signed by the Mayor on July 12, 1985; and

G. First Source Agreement with the Mayor's Office of Jobs and Community Services.

2.1 Financial Information/Role of Brigham and Women's Hospital

Financial information for the Brigham and Women's Hospital (BWH) participation in the Smith Research Laboratories Project is based on a commitment to the space only at the present time. BWH will be assigned to two of the research floors and will participate in use of the animal facilities. The Hospital will have a twenty-year lease after which time space occupied by BWH will be returned to Dana-Farber uses.

2.2 Linkage Contributions and PILOT Payments

Dana-Farber will pay linkage payments of $681,550, based on $5.00 per 1,000 FAR square feet for housing and $1.00 for jobs; Dana-Farber will also pay $90,375 annually in a PILOT payment based on the Smith Laboratories' current design/building program.

2.3 Commitments to Employment and Training Benefits

Chapter I, Section 4.4.2 outlines Dana-Farber's commitment to target employment and training benefits to Mission Hill and Boston residents.

2.4 Analysis of Institute Work Force

Information on Dana-Farber's work force, particularly those who are Mission Hill residents, is contained in Chapter I, Section 4.4.2. In general, job classifications for Mission Hill residents span the range of classifications for all Institute employees from general support to physicians.

2.5 Clarification of Community Services Provided by the Institute

Updated information on community benefits is described in Chapter I, Section 4.4.2.

2.6 Clarification of Trip Generation

Trip generation estimates have been calculated based on the number of employees. See Response to Comment 1.13.

2.7 Mitigation at Brookline Avenue/Deaconess Road Intersection

Dana-Farber has agreed to contribute $45,000 to the Boston Transportation Department for implementation of signal improvements along Brookline Avenue as specified by the City. This commitment will be incorporated into Dana-Farber's TMA Agreement with the City.

2.8 DPIR/DEIR Parking Supply Numbers

Chapter IV provides corrections to errors contained in the DPIR/DEIR. Specifically, the inconsistencies in parking numbers between Figure 1-4 and Table 1-4 have been corrected.

2.9 Utilization and Allocation of Future Parking Spaces

The proposed number of new parking spaces has decreased from 261 in the DPIR/DEIR to 246 (by 15 spaces). Our analysis of overall Dana-Farber parking versus overall square footage (including the new 246-space garage) is that the Dana-Farber Cancer Institute will provide overall close to 1 space for each 1,000 sf of total floor area owned by the Institute. This ratio is consistent with the overall Longwood Medical Area (LMA) ratio for all institutions based on information provided by MASCO.

2.10 Analysis of Visitor/Patient Parking Demand

Table IV.1-3 has been revised to indicate the current assignment of visitor/outpatient spaces in the Dana Garage. The future analysis assumes a peak hour demand for 138 spaces in 1998, all to be assigned to the Dana Building garage (see Table IV.3-4).

2.11 Mitigation Program Effects

The mitigation proposed in the DPIR/DEIR and in this report analyzes the relationship of parking demand and supply. We think this information may have been missed by the Boston Transportation Department in its review of the DPIR/DEIR. In addition, traffic conditions are expected to improve with the new mitigation proposed but will not lead to LOS improvement, except at the Deaconess Road/Brookline Avenue intersection where LOS will improve from F to B in the AM and PM peak hours Build Condition.

2.12 Pedestrian Level Winds

The design of the project has been modified since the DPIR/DEIR. There is no longer a two-story arcade along Binney Street or along the north side of the building facing Brookline Avenue. In addition, the proposed mini- park area adjacent to the MATEP facility was eliminated in response to the Boston Civic Design Commission review of the Project. Based on the wind analysis, wind is not expected to be a problem along Deaconess Road. A full and updated pedestrian level wind analysis is contained in Chapter V, Section 1.0 based on the revised design.

2.13 Shadow Impacts

Joslin Park will be affected by shadow late morning during the late fall (November 21) or winter, and not at any other time as originally scoped by the BRA for the DPIR. The new

times analyzed in this report are during the colder months when use of the park is more limited or not at all. A full and updated analysis is contained in Chapter V, Section 2.

2.14 *Daylight Analysis*

The revised design as approved by the BRA provides for a greater building setback at Binney Street, which will lead to improvements in daylight values along Binney Street. With the above changes in Project design, the Project proponent is of the opinion that sufficient mitigation results from the new design to satisfy the BRA's daylight analysis. A full and updated analysis is contained in Chapter V, Section 3.

2.15 *Air Quality Receptor Identification*

The graphic figures showing the air quality receptors used in the evaluation have been reprinted in Chapter V, Section 4, with labels consistent with the table designations.

2.16 *Boston Fire Department Receptor*

One of the receptors in the Air Quality analysis was incorrectly labeled "Boston Fire Department." This label has been corrected to read "Boston Five ATM."

2.17 *Summary of MATEP Air Quality Data*

A summary table presently MATEP near field air quality data collected is provided in Chapter V, Section 4.

2.18 *Noise Analysis Receptor Locations*

Noise receptor locations and model results tables, showing consistent label designations are reprinted in Chapter V, Section 5.

2.19 *Evaluation of Permanent Dewatering System on Groundwater Maintenance in Adjacent Areas*

The perimeter slurry (foundation) wall will be toed into the bedrock. Therefore, minimal seepage of water is expected from surrounding areas into the portion below the basement of the Smith Research Laboratories. Groundwater levels in adjacent areas are not expected to be affected by the Project. Chapter V, Section 6 presents additional information.

2.20 *Construction Impacts*

The Smith Research Laboratories Traffic Maintenance Plan will be focused on minimizing impacts on adjacent sensitive receptors adjacent to the construction site. Construction hours (generally 7:00 AM to 4:00 PM) should not impact nearby residential

areas which are two blocks away. A more complete discussion of construction impacts is presented in Chapter V, Section 7.

2.21 Consistency of Tables

The Daytime Ambient Noise Survey was completed on August 4, 1993. The comment noting conflicting dates was based on an error in Table V.9-2 which has been corrected.

2.22 Demolition and Construction Waste Recycling

The contractor will initiate a construction recycling program as outlined in Chapter V, Section 7.

2.23 Truck Routing During Construction

Truck routing during construction will be along Brookline Avenue to Deaconess Road (and the site). Truckers will be directed to avoid use of Francis Street between Binney Street and Brigham Circle where residences are located.

2.24 T-Passes to Construction Workers

The Institute will discuss with MASCO the possibility of construction workers using off-site facilities operated by MASCO in the Fenway or at other locations as an alternative to providing T-passes.

2.25 Inclusion of Background Infrastructure Projects

Information on the Deaconess Clinical and Research Facility projects, and the Joslin Diabetes Center Research and Clinical Facility is included as background projects in the Infrastructure Systems Component.

2.26 Capacity of Medical Area Total Energy Plant (MATEP)

There are currently future chilled water capacity constraints at MATEP. Various ways for Dana-Farber to provide for additional chilled water capacity are under review, including a system of satellite chillers interconnected to MATEP, or a stand alone chiller plant either owned and operated by Dana-Farber or MATEP. Please refer to Chapter VII, the Infrastructure Systems Component for additional information.

2.27 Location of Stormwater Line in Deaconess Road

The Deaconess Road stormwater line has been added to the sewer system graphic figure (Figure VII.2-1).

2.28 Institutional Master Plan

Changes have been made to the Institutional Master Plan in the final document approved by the Boston Zoning Commission on March 29, 1994 as the basis for the approval of the Dana-Farber Institutional Zoning District.

2.29 Status of Article 31 Development Review Agreements

The Boston Residents Construction Employment Plan, First Source Agreement, Development Impact Project Agreement and the Cooperation Agreement have all been fully executed by Dana-Farber and the appropriate City of Boston agency or department. The Transportation Access Plan Agreement is in draft form, and the Traffic Maintenance Plan will be finalized prior to the initiation of construction.

3.0 CITY OF BOSTON ENVIRONMENT DEPARTMENT

Received From: Lorraine M. Downey, Director

Date. December 3, 1993

JD

City of Boston
The Environment
Department

THOMAS M. MENINO
Mayor

Lorraine M. Downey
Director

Boston City Hall/Room 805
Boston, Massachusetts 02201
617/635-4416 or 635-3850

December 3, 1993

RECEIVED
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MEPA

Secretary Trudy Coxe
Executive Office of Environmental Affairs
100 Cambridge St. 20th Floor
Boston, MA 02202

Attn.: Jollene Dubner, MEPA Unit
RE: EOEA #9452, Dana-Farber Cancer Institute New Research Building, Longwood Medical Area (LMA), Boston

Dear Secretary Coxe:

The City of Boston Environment Department has reviewed the Draft Environmental Impact Report/Draft Project Impact Report (DEIR/DPIR) for the proposed project referenced above and hereby submits the following comments in response:

In general, the DEIR/DPIR adequately addresses the issues of concern to the Environment Department, and adequately responds to the issues raised in the MEPA and BRA scopes. The Environment Department therefore recommends that the Secretary certify the adequacy of the DEIR/DPIR. Some areas of concern remain for resolution in the FEIR/FPIR, however.

While generally adequate, the proponent can still improve the traffic and parking management plan. Dana-Farber currently provides a 25% transit subsidy to its employees, and the DEIR/DPIR implies that the Institute will offer this same level of subsidy to workers in the new building. Dana-Farber should expand the transit subsidy offered to its employees. The nearby Deaconess hospital plans to offer 50% transit subsidies by 1998. Dana-Farber should commit to this same progressive policy. 3.1

The DEIR/DPIR aims for an 8% walking/cycling modal share for its employees by 1998. The Environment Department commends the proponent for recognizing the potential for these forms of commuting. The Department encourages the proponent to aim for at least a 10% walking/cycling modal share, however. 3.2

The DEIR/DPIR projects an increase of 138 parking spaces on the Dana-Farber campus upon project implementation. (The proponent has subsequently reduced

this number by about 10-15 spaces.) As always, the Environment Department expresses concerns with new parking facilities in the congested Longwood area. The proponent should examine methods of relieving some of the need for these new parking spaces, and report on the findings in the FEIR/FPIR. 3.3

The DEIR/DPIR projects a decline in vehicular LOS from C to F at the Brookline Ave./Deaconess Road intersection in 1998 as a result of the project. The average delay at this intersection will increase from 18.7 to 136.0 seconds (Table IV 3-2). The proponent commits to "cooperate with MASCO" in making traffic improvements in the LMA. The FEIR/FPIR should include more specific plans, especially at the Brookline Ave./Deaconess Road intersection. 3.4

The historic resources section omits mention of the Riverway as an historic resource and designated Landmark in the project area. However, the proposed project does not appear to negatively impact the Riverway. 3.5

The proposed building continues to undergo refinements in urban design through the Boston Civic Design Commission (BCDC). This process has already produced significant improvements over the design presented in the DEIR/DPIR. Redesign has eliminated one of the proposed pedestrian bridges and increased the setback from Binney St., obviating the need for a pedestrian-level arcade along Binney St. The Environment Department supports both of these design refinements. The FEIR/FPIR should present the changes made as a result of BCDC review. 3.6

The DEIR/DPIR adequately addresses the issue of construction and operational noise, and projects full compliance with City standards. The proponent should note that the 86 dBA construction noise limit mentioned in section 9.6.7 applies only to properties in residential or institutional use.

The Certificate on the Environmental Notification Form mentions the ongoing efforts by the City to prepare a master plan for the entire Longwood Medical Area, and mentions that the proponent will prepare an institutional master plan as well. The flurry of recent planning and construction activity in the Medical Area necessitates close coordination among the member institutions, the City, and the Commonwealth. The FEIR/FPIR should explain the relationship of the Dana-Farber project to other recent LMA projects, how the project fits into the City's LMA master plan, and how Dana-Farber will ensure necessary coordination to successfully integrate the project into its surroundings.. 3.7

In summary, the Environment Department recommends that the Secretary certify the DEIR/DPIR, and awaits the continued refinement of the project in the FEIR/FPIR.

I thank you for your time and attention.

Sincerely,

Lorraine M. Downey

Lorraine M. Downey
Director

LMD/AP:ap

cc: Beverly Johnson, BRA

3.1 Increase in Transit Subsidy

Transit subsidies provided by hospitals within the LMA average approximately 25% of the cost of a T-Pass. Dana-Farber is an active participant in MASCO's Commuter Mobility Program which includes commitments to carpooling, ridesharing, and vanpooling. Dana-Farber was the first LMA institution to offer a vanpool subsidy to its employees. Also, see Response to Comment 1.9.

3.2 Increase in Walking/Cycling Modal Share

While Dana-Farber will continue to carry a more conservative 8% walking/bicycling modal share target for 1998, it will locate bicycle racks in convenient campus locations and make shower facilities for bicyclists available, wherever possible.

3.3 Relieving Need for New Parking Spaces

Dana-Farber is in the process of negotiating a Transportation Access Plan (TAP) Agreement with the Boston Transportation Department. The TAP Agreement will provide a comprehensive listing of, and commitment to, traffic and parking reduction measures to be provided by the Institute for the Smith Research Laboratories.

3.4 Brookline Avenue/Deaconess Road Improvements

As noted in our response to Comment 1.4, Dana-Farber will make a $45,000 contribution to the City of Boston for signal upgrading and overall signal coordination along Brookline Avenue between the Riverway and Longwood Avenue, which includes the Deaconess Road intersection.

3.5 The Riverway as a Designated Landmark or Historical Resource

The Riverway is identified in the FPIR/FEIR as a designated National Register property.

3.6 Changes Resulting from BCDC Review

Dana-Farber's new design results from reviews with the BRA, Mission Hill PZAC, and the Boston Civic Design Commission (BCDC). Dana-Farber's architects initially presented plans to BCDC in November 1993. This design was reviewed at numerous meetings with BCDC and its subcommittee. In response to the BCDC issues, Dana-Farber increased the building's setback at Binney Street by 12 feet (from 7 feet to 19 feet from the curb); the building height was reduced by 10 feet (from 194 feet to 184 feet); and the parking entrance was relocated along Deaconess Road to within the building.

3.7 Discussion of Relationship of the Dana-Farber Project to Other Recent LMA Projects

Dana-Farber Cancer Institute is an active participant in City-sponsored master planning for the Longwood Medical Area. This effort, being directed by the Boston Redevelopment Authority in coordination with LMA institutional representatives, MASCO and residential community participants from nearby Fenway and Mission Hill, is scheduled for completion in calendar 1994. The BRA has reviewed the Smith Research Laboratories Project as it relates to the current LMA planning effort. The Project is consistent with general principles guiding this study, including the avoidance of negative impacts on the City's existing housing stock or on existing park land or open space resources. It also consolidates existing inefficient uses into one facility and provides for joint use of a facility by two or more institutions which are objectives of the City's planning.

The Dana-Farber Cancer Institute is being planned at the same time that New England Deaconess Hospital is proposing a Research Facility (EOEA #8776) on the other side of Brookline Avenue, and Harvard Institutes of Medicine is proposing the renovation of the former English High School to a Research Facility (EOEA #9428). All three projects demonstrate the importance of new research to the survival and leadership of these institutions in their key research areas. Research supports not only medical education but clinical excellence, a critical aspect of all of these Harvard teaching hospitals.

Finally, the construction planning of all of these new projects will be coordinated to minimize street occupancy and traffic disruption. This coordination will occur through the Transportation Access Plan Agreements with the City which are required for each project. (See Response to Comment 1.2 for additional discussion.)

4.0 BOSTON WATER AND SEWER COMMISSION

Received From: John P. Sullivan, Jr., P.E., Chief Engineer

Date: December 8, 1993

In its comment letter, the Boston Water and Sewer Commission (BWSC) stated that the DPIR/DEIR adequately addressed their concerns.

Boston Water and Sewer Commission

425 Summer Street
Boston, MA 02210-1700
617-330-9400
Fax 617-330-5167

RECEIVED
DEC 1 3 1993
MEPA

JD

December 8, 1993

Ms. Trudy Coxe, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street, 20th floor
Boston, MA 02202

Attn: MEPA Unit

FAX: 727-2754

Re: Draft Project/Environmental Impact Report
Dana-Farber Cancer Institute
New Research Building
EOEA No. 9452

Dear Secretary Coxe:

The Commission has reviewed the Draft Project/Environmental Impact Report (DP/EIR) for the Dana-Farber Cancer Institute's New Research Building. The site is located at the corner of Binney Street and Deaconess Road. Currently the site is occupied with a three-story building, a small garage and a surface parking lot.

The proposed New Research Building will consist of approximately 238,320 gross square feet of space used for research, office and research support. The building will also have five below-grade parking levels for 261 cars.

The domestic water demand for the building is estimated at 60,480 gallons per day (gpd). The building's refrigeration plant will require an additional 158,200 gpd on average during the peak months of July and August. During the rest of the year the building's cooling needs will be met by MATEP.

The domestic sanitary sewage generated by this project will be approximately 54,500 gpd. In addition, approximately 60,000 gpd from a cooling tower blowdown will be discharged to the sanitary sewer during a peak month.

Stormwater from the underground garage will be routed through a grit chamber and then through an oil separator before being discharged to the Commission's storm drainage system.

The Commission finds that our earlier comment have been adequately addressed.

The proponent will be required to submit a site plan showing water, sewer and drain connections which conform to the Commission's regulations.

Since the project is a medical research facility, the proponent should refer to the Article IV of the Commission's Sewer Use Regulations.

Thank you for the opportunity to comment on this project.

Sincerely yours,

John P. Sullivan, Jr., P.E.
Chief Engineer

JPS/LB/PK/gf
cc: John W. Petit, Dana Farber
Mitchell Fischmann, HMM
Richard Mertens, BRA
P.J. Foley, BWSC
S. Shea, BWSC
Susan Norton, MWRA

5.0 DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF AIR QUALITY CONTROL

Received From Christine Kirby

Date: December 8, 1993

In its comment letter, the Department of Environmental Protection, Division of Air Quality Control, stated that the DEIR microscale analysis showed no predicted exceedances.

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

William F. Weld
Governor
Daniel S. Greenbaum
Commissioner

RECEIVED
DEC 9 1993
MEPA

MEMORANDUM

TO: Secretary Coxe, Executive Office of Environmental Affairs

ATTN: Jollene Dubner, MEPA

FROM: Christine Kirby, DEP

DATE: December 8, 1993

SUBJECT: EOEA No. 9452: Proposed New Cancer Research Building at Dana-Farber Hospital in Boston: Comments on the DEIR

The Department of Environmental Protection (DEP) Division of Air Quality Control (DAQC) has reviewed the DEIR for the Proposed New Cancer Research Building in Boston and offers the following comment. The microscale analysis for this project showed no predicted exceedances of the National Ambient Air Quality Standards (NAAQS) for carbon monoxide.

Should you have any questions pertaining to this memorandum please contact Keith Grillo of the DAQC at 292-5773.

One Winter Street • Boston, Massachusetts 02108 • FAX (617) 556-1049 • Telephone (617) 292-5500

6.0 BOSTON REDEVELOPMENT AUTHORITY

Received From	Paul Reavis, Assistant Director for Engineering and Design Services
Date:	December 2, 1993

In its comment letter, the Boston Redevelopment Authority confirmed that the Draft Environmental Impact Report (DEIR) was also being submitted as a Draft Project Impact Report (DPIR), and stated that the Boston Redevelopment Authority would issue a Preliminary Adequacy Determination on the DPIR/DEIR following a 30-day public review period.

Boston
Redevelopment
Authority

Clarence J. Jones, *Chairman*
Paul L. Barrett, *Director*

3D

DEC 2 1993

Secretary Trudy Coxe
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

RECEIVED
DEC 3 1993
MEPA

Attention: MEPA Unit

Re: EOEA #9452 Dana-Farber Cancer Institute New Research Building/Draft Environmental Impact Report

Dear Secretary Coxe:

Pursuant to regulations implementing M.G.L., Chapter 30, Sections 62-62H, the Boston Redevelopment Authority submits the following comments with regard to the above-referenced Draft Environmental Impact Report:

In voluntary compliance with the requirements of Article 31 of the Boston Zoning Code, the Draft Environmental Impact Report for the Dana-Farber Cancer Institute New Research Building project in the Longwood Medical Area of Boston also has been filed as a Draft Project Impact Report. The Boston Redevelopment Authority currently is completing its review of this report and will be issuing a Preliminary Adequacy Determination to the project proponent following the 30-day public review period. A copy of the Preliminary Adequacy Determination will be forwarded to your office at that time.

Sincerely,

Paul Reavis
Assistant Director for
Engineering and Design Services

cc: Mr. John W. Pettit
Chief Administrative Officer
Dana-Farber Cancer Institute

One City Hall Square
Boston, MA 02201-1007
Telephone (617) 722-4300
Fax (617) 367-5916

7.0 MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Received From Jane O'Brien, Project Coordinator/Planning

Date: December 9, 1993

MASSACHUSETTS
BAY
TRANSPORTATION
AUTHORITY

Ten Park Plaza, Boston, MA 02116

RECEIVED
DEC 1 1993
MEPA

December 9, 1993

Trudy Coxe, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street - 20th floor
Boston, Massachusetts 02202

Attention: Jollene Dubner
MEPA Unit

Subject: New Research Building, Boston
Dana Farber Cancer Institute
Draft Project Impact Report/Draft
Environmental Impact Report (DPIR/DEIR)
EOEA No. 9452

Dear Secretary Coxe:

The Massachusetts Bay Transportation Authority (MBTA) has reviewed the Draft Project Impact Report/Draft Environmental Impact Report (DPIR/DEIR) for the Dana-Farber Cancer Institute New Research Building, 65 Deaconess Road, Boston, MA. The project involves the construction of a 14-story building consisting of 322,000 gsf of new research, office and support service space and five below grade parking levels providing space for 261 vehicles. Listed below are some areas of concern to the MBTA.

The report correctly lists the MBTA bus routes that travel through the Longwood Medical Area (LMA). It also lists a transit modal split of 30% for the Institution's employees. Given the relatively high degree of ridership, the MBTA's ability to move buses through the area is of great concern. The report for the proposed development states on Page IV-33, 3.4 - 1998 Building Traffic Operations "The most significant impact will occur at the intersection of Brookline Avenue and Deaconess Road where LOS F conditions will occur during the AM peak hour due to the garages's proximity." However, the report offers no proposals to mitigate this severe 7.1
impediment to vehicular movements. The MBTA operates bus route 60 and route 65 through this intersection. The MBTA requests adequate mitigation measures for this intersection be committed to by the developer.

Various developments in the Longwood Medical Area results in nearly 1000 new parking spaces within the next five years. The effects of all this increased demand on intersections may be seen by comparing the changes in LOS for intersections within the LMA. While the changes in the Level of Service for the intersections are not exclusively the result of the proposed Dana-Farber Research Building, the impacts of the continued growth will be felt by all. The MBTA continues to be concerned with the overall deterioration in the Level of Service of these intersections.

Once again, thank you for the opportunity to comment on this project.

Sincerely,

Jane O'Brien

Jane O'Brien
Project Coordinator/Planning

JOB/amm

7.1 Brookline Avenue/Deaconess Road Intersection Mitigation

Dana-Farber has agreed to provide $45,000 to the Boston Transportation Department to be used for upgrading of traffic signals at and around the Brookline Avenue/Deaconess Road intersection and along Brookline Avenue between the Riverway and Longwood Avenue. Such improvements may include new loop detectors and controllers to better coordinate signal timing.

7.2 Deterioration in Level of Service in the LMA

Dana-Farber's impacts on traffic should be substantially mitigated at the Brookline Avenue/Deaconess Road intersection as discussed in our response to comment 7.1. Dana-Farber is an active participant in MASCO, which is working to address area-wide traffic needs and improvements (see Appendix D, letter from MASCO, for listing of MASCO's LMA priority transportation improvements).

APPENDIX A
BRA Preliminary Adequacy Determination and Secretary's Certificate

DANA-FARBER
CANCER INSTITUTE

Boston Redevelopment Authority

2 May 1994

Mr. John W. Pettit
Chief Administrative Officer
Dana-Farber Cancer Institute
44 Binney Street
Boston, MA 02115

Dear Mr. Pettit:

Re: Dana-Farber Cancer Institute New Research Building: Preliminary Adequacy Determination

This letter is the Preliminary Adequacy Determination (the "Determination") of the Boston Redevelopment Authority (BRA) with respect to the Draft Project Impact Report (DPIR) submitted by Dana-Farber Cancer Institute regarding the New Research Building (the "Proposed Project").

The Proposed Project is being reviewed pursuant to Section 31-5 of the Boston Zoning Code. The BRA is issuing the Determination which requests additional information required by the BRA in order to proceed with the review of the Proposed Project. The Technical Appendix attached to this letter identifies specific areas of concern and requests preparation of additional information and investigation of additional mitigation measures. Apart from these issues, the balance of the DPIR submitted is sufficient to satisfy the scoping requirements.

Article 31 of the Code sets out a comprehensive procedure for project review and requires the promulgation of an Adequacy Determination (AD) prior to the issuance of a building permit. The AD is issued upon determination by the BRA that the Final Project Impact Report provides satisfactory evidence that adequate mitigation strategies have been generated for all potential adverse impacts for the Proposed Project. We look forward to reviewing the Final Project Impact Report.

Sincerely,

Beverley E. Johnson

Beverley E. Johnson
Assistant Director for Institutional Planning and Development

TECHNICAL APPENDIX

TO THE

PRELIMINARY ADEQUACY DETERMINATION

FOR

THE DANA-FARBER CANCER INSTITUTE

NEW RESEARCH BUILDING PROJECT

I. DEVELOPMENT REVIEW REQUIREMENTS - ARTICLE 31

Article 31 of the Boston Zoning Code promulgates a process by which large-scale development projects are reviewed by the Boston Redevelopment Authority (BRA) and the public to ensure that they enhance the public welfare. Subsequent to the submission of the DPIR the proponent generated urban design modifications based on public comments as well as recommendations from BRA staff and the Boston Civic Design Commission. The Project size has been reduced from 290,000 square feet to a floor area of 213,592 square feet, a height of 184 feet and contains 13 floors above grade. In its review of the DPIR in light of the modified Project and the public comments which were received, the BRA has identified a number of project issues which will require additional analysis and clarification. The proponent must adequately respond to the issues that are raised herein in its submission of the Final Project Impact Report (FPIR) in order for the BRA to find the project mitigation measures satisfactory and issue a Final Adequacy Determination (FAD). The following is a description of the BRA's review of the DPIR and the additional information which must be included in the FPIR.

A. General Information

The following additional general information is requested.

The financial information presented fails to describe the terms of the participation of Brigham and Women's Hospital in the project.

The amounts estimated for linkage contributions and the PILOT needs to be stated in the FPIR.

The discussion of employment and training benefits does not adequately describe the Institute's commitment and efforts to target such benefits to Mission Hill and Boston residents. An analysis of the existing institute workforce, which identifies the

percentage of Boston and Mission Hill residents by job and salary category needs to be presented as the basis for designing programs to enhance community benefits.

The description of community services provided by the Institute, wherever possible, should clarify what Boston based organizations benefit and in what way.

B. Transportation Component

The review of the DPIR by the Boston Transportation Department follows.

Traffic/Trip Generation. Section 3.1 states that ITE rates, adjusted by mode split assumptions, were used to calculate vehicle trip generation. If, as indicated in Table 4-1, the number of new employees is known, that number should have been used as the basis for trip generation factors; or, in any case, some discussion should have been presented of the relationship between full-time day employees and peak hour trips.

The intersection analysis indicates that the level of service at the Deaconess/Brookline intersection deteriorates from a C to an F, with over two minutes of delay, between the no-build and build condition. Specific mitigation needs to be offered in the FPIR which would prevent the failure of this important intersection.

Parking Supply. In terms of project design review, the most important issue is parking. The parking supply/demand relationships need to be carefully and correctly analyzed. The DPIR contains a number of errors and inconsistencies which require clarification before a decision can be reached regarding the appropriate number of parking spaces in the development.

The scope calls for "A clear program... for the utilization of the proposed parking in the new facility as well as remaining spaces in the existing facility and other spaces owned, operated or used by" the Institute. No detail is provided of the utilization and allocation of parking in the future condition. Furthermore, the only discussion of future parking conditions (in the Mitigation section) refers to: (1) the Institute continuing to lease 218 spaces in the LMA, whereas Table 1-4 shows 16- spaces leased in the LMA; and (2) 326 off-site and nearby spaces, which would seem to correlate with the MASCO spaces cited in Section 1, whereas Section 1 identifies 362 such spaces.

The purpose of the parking analysis is to justify the proposed project's parking component, by placing new parking demand generated by the project in the context of existing supply and demand. The inconsistencies and omissions in the DPIR make it impossible to evaluate the number of parking spaces proposed. It does appear that the number is too large, since it would yield more than one new space for every two new employees, a ratio considerably higher than that for the LMA as a whole.

However, many spaces are in the Institute's total supply, patients and visitors must be accommodated, in adjacent, convenient facilities. Thus the analysis of patient/visitor parking demand is important. However, none is provided. Section 3.5 seems to state that the 138 spaces at the Dana Building are assumed to be sufficient for patient/visitor parking, but Table 1-4 shows an "assignment" of 160 patients/visitors at the site. The source of this number should be revealed, and the apparent shortfall addressed.

Mitigation. The general mitigation program is directed at minimizing overall vehicle-trip generation through a series of commuter mobility program measures. While these actions are appropriate, it is not clear either that they will have the effect predicted -- for example, the achievement of a 15% carpool share -- or what effect they will have on overall traffic conditions.

C. Environmental Protection Component

1. Wind

The wind impact assessment should be modified in light of the current project design.

For ease of reference, the existing and build condition figures should be placed on facing pages, not back-to-back (done for NW and SW winds, but not for the easterly winds).

Some of the building heights noted in the text do not match with the heights given in Fig. V.1-1 (e.g., Dana Building).

2. Shadow

The shadow studies should be refined based on the reduced project size.

The statement in the fifth paragraph of section 2.5 is incorrect, since Fig. V.2-12 clearly shows that Joslin Park will be affected by project shadows in the late mornings of winter. Joslin Park is impacted by shadows in December and possibly from October through February by shadows in the late morning until just after noon. Further, evaluations for 10:00 a.m., 11:00 a.m. and 12:00 Noon are recommended for October 21, November/January 21, December 21 (10 a.m., 11 a.m., 1 p.m., 2 p.m.), and February 21. Early afternoon studies on December 21 may reveal some impacts on the fields at Longwood and Brookline.

3. Daylight Analysis

The daylight analysis needs to be recalculated for the reduced project.

4. Air Quality

For ease of reference, the receptor identification on the figures should also include the numerical designation given in Table V.4-1. Both figures and tables should have consistent identification.

What is the "Boston Fire Dept." receptor identified in Figure V.4.1?

The actual height of the MATEP stack should be given. Does it conform to the GEP stack height determined from the 1988 MATEP study?

A summary of the MATEP air quality data would be helpful for review of the potential stack effects.

5. Solid and Hazardous Wastes

The information presented satisfies the scoping requirement.

6. Noise

The receptor identification should be keyed to the numbers on Figure V.7-2. In addition, the height of the receptors should be given (ground level, elevated, etc.).

7. Geotechnical Impact

The impact of the permanent dewatering system on groundwater level maintenance in the adjacent areas should be evaluated.

8. Construction Impacts

Due to the several sensitive receptors in the area (hospital facilities), particular care will need to be exercised during the construction period to minimize as much as possible adverse impacts from excessive noise, dust and pollutant emissions, etc. The proximity to residences on Francis Street raises concern that construction hours may need to be restricted.

Table V.9-2 is identical with Table V.7-2 but shows a different date. Which is correct?

It is recommended that demolition and construction waste be recycled to the extent possible rather than be disposed of in scarce landfills.

A truck route which does not use Francis Street needs to be identified. The residents of Francis Street and the Mission Hill PZAC have requested that Francis Street not be used as a truck route.

The Institute is encouraged to provide T-passes to construction workers to discourage parking in the area.

D. Urban Design Component

1. Scoping Determination Issues

The following issues raised in the Scoping Determination have been adequately addressed in the DPIR.

a. Project Location

The analysis of alternative sites indicated that it was not feasible to build the project on any other parcel owned by Dana-Farber because of the need to maintain continuous operation of facilities on the other parcels, to design a compact and efficient floor plate, to provide adjacency between clinical and research activities, and to accommodate parking in the proposed project.

b. Building Height and Bulk

The building bulk was reduced by 11% to 238,300 FAR square feet and the FAR was reduced from 10.2 to 8.3. The visual impact of the building mass was substantially modified through the design review process by stepping back the upper corners to taper the mass, by differentiating the materials of the middle of the building from those of the corners to emphasize slimmer proportions, and by articulating the top of the central bay below the penthouse levels to minimize apparent height.

c. Streetscapes

The size of the proposed pedestrian bridge above Deaconess Road was reduced from two- to one-story and its width from 100 feet to 10 feet. Both bridges are at least 22 feet above the street and are made primarily of transparent materials.

All of the Dana-Farber pedestrian areas, both proposed and existing, will be improved with new paving, tree-planting, street furniture, and lights, and views of adjacent service areas and parking ramps will be improved by introducing new walls and planters.

d. Building Character

The image of the building proposed in the PNF has been significantly modified. A stronger, better-proportioned masonry wall with punched openings has replaced the infilled frame design and a more deliberate expression of the penthouse and rooftop mechanical equipment will provide an improved skyline view.

2. Subsequent Issues

The following issues were raised in reviews by the Mission Hill PZAC and the Boston Civic Design Commission and have been adequately addressed in Schematic Design drawings dated January 7, March 1, and March 4, 1994.

a. Sidewalk Setback

The street-level building arcade was deleted and the sidewalk width increased from 6'-6" to 19'-6" to provide substantially more pedestrian circulation space and ambient light along Binney Street and a less abrupt change in scale along the sidewalk regarding the high building wall.

b. Garage Access

The ramps to basement parking levels were located within the building where they will be less noticeable than in their previous location alongside the building. Garage doors in the new location will also be used to conceal the ramps and improve the appearance.

c. Pedestrian Bridges

The public streetscape will be improved by the deletion of the existing pedestrian bridge connecting the Jimmy Fund and Dana Building at the second floor, crossing Binney Street diagonally. It will be replaced by the proposed bridges at the third floor, 24 feet above the street, transparent in design, and crossing the streets more comfortably at a right angle.

d. Building Height and Bulk

Project proponents have deleted one floor of research space from the program. This results in a reduction in building height of 10 feet to 184 feet and a reduction of FAR gross floor area from 238,000 to 214,000 square feet.

E. Historic Resources Component

The information presented satisfies the scoping requirement.

F. Infrastructure Systems Component

Inclusion of background projects as required by the scoping is not clear. Additionally, the project demands are not presented as percentages of available system capacities as requested. This is particularly critical in the LMA, which is evolving into a demand-intense densely developed area. For instance, the gpm peak requirements of water usage and chiller requirements are not given, but may add up to a significant percentage of available capacity - not including other projects in the area. The sewer system has the same limiting pipe segment as Deaconess and Joslin - but these projects are not referenced, nor is available capacity discussed. MATEP's chilled water capacity expansion via the plant proposed as part of this Project should be further discussed. It does not seem to be assisting, say, the Deaconess Research project proposal, which plans a similarly-sized plant (3,000 tons, downsized from 6,000) on the roof of an existing garage directly across from apartment buildings.

Although electricity appears to be in adequate supply, again, MATEP's demand/capacity relationship is not cited.

A 12-inch line in Deaconess Road is noted but is not shown on Fig. VIII.2-1 (2.5 Storm Water Drainage)

II. INSTITUTIONAL MASTER PLAN

The Institutional Master Plan has been modified to reflect comments received from BRA staff.

III. AGREEMENTS

In addition to completing the Article 31 Development Review and the Institutional Master Plan requirements, the agreements and plans listed below must be provided in form and content satisfactory to the relevant signatory public agencies before building permits shall be issued for the project.

A. Development Impact Project (DIP) Plan and Agreement including provisions for a Housing Contribution Grant and Jobs Contribution Grant pursuant to Articles 26A and 26B of the Code;

B. PDA Development Plan pursuant to Section 3-1A of the Code;

C. Cooperation Agreement;

D. Transportation Access Plan (TAP) Agreement;

E. Traffic Maintenance Plan in conformity with the City's Construction Management Program;

F. Boston Residents Construction Employment Plan, pursuant to Chapter 12 of the Ordinances of 1986 of the City of Boston, as amended by Chapter 17 of said Ordinances, and Executive Order Extending Boston Residents Job Policy, signed by the Mayor on July 12, 1985; and

G. First Source Agreement with the Mayor's Office of Jobs and Community Services.

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

WILLIAM F. WELD
GOVERNOR

ARGEO PAUL CELLUCCI
LIEUTENANT GOVERNOR

TRUDY COXE
SECRETARY

Tel (617) 727-9800
Fax (617) 727-2754

December 16, 1993

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	:	Dana-Farber Cancer Institute New Research Building
PROJECT LOCATION	:	Boston
EOEA NUMBER	:	9452
PROJECT PROPONENT	:	Dana-Farber Cancer Institute
DATE NOTICED IN MONITOR	:	November 7, 1993

The Secretary of Environmental Affairs herein issues a statement that the Draft Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L., c. 30, s. 61-62H) and with its implementing regulations (301 CMR 11.00).

Dana-Farber proposes to construct a new research building at 65 Deaconess Road in the Longwood Medical Area (LMA) of Boston. The project will add 290,000 gross square feet in 14 stories and a 261 space below grade garage. The project site is 28,845 square feet and is currently occupied by a small 3-story building and a 58 car surface parking lot. The Longwood Medical Area is a 175 acre area within the City of Boston roughly bounded by Huntington Avenue, the Fenway and the Riverway. The project will also house space for research for Brigham and Women's Hospital, which is nearby. There is a proposed bridge on the third level that will link the project to Brigham and Women's Hospital. The project is estimated to have 420 new employees.

This document is a joint Environmental Impact Report/Project Impact Report (EIR/PIR), and a Determination of Adequacy is expected shortly from the Boston Redevelopment Authority (BRA). In addition, the Draft EIR/PIR states that Dana-Farber submitted a draft Institutional Master Plan to the BRA on August 4, with revision on September 24, 1993. In the main, the DEIR/PIR under review herein adequately responds to the Certificate on the Environmental Notification Form that was issued by this office.

The Final EIR/PIR should resolve the remaining issues, as outlined below, as well as issues to be outlined in the BRA's upcoming Determination of Adequacy. It should also address the comments received on the DEIR/PIR.

As noted in my November 1, 1993 Certificate on the Draft Environmental Impact Report for the Harvard Institutes of Medicine, EOEA #9428, the Longwood Medical Area has continued to grow, despite the economy. The list of new projects in the LMA is extensive, totalling approximately 2.2 million square feet in the next five years, exclusive of the Dana-Farber New Research Building. Although the incremental impacts of each new development appear to be manageable, these developments combined will contribute significantly to traffic congestion and air pollution. It is clear that, given the traffic growth forecasts for this area, there is a need for transportation systems improvements that could be far reaching. These large scale improvements are beyond the scope of the impacts from the Dana-Farber project alone. Short range improvements commensurate with an individual project's impacts should be the responsibility of individual proponents to ensure that further deterioration of poor traffic conditions is avoided.

The remainder of this Certificate will focus on the DEIR analysis and issues to be resolved and considered in the FEIR. These issues relate primarily to traffic and transportation.

General

The DEIR/PIR does a good job describing the visual impacts, wind impacts, air quality impacts, water and sewer impacts, shadow impacts and impacts on historic and parkland resources. I note that the shadow and wind impact studies are particularly well prepared, readable and understandable. The project does not negatively impact the Riverway, which is an historic resource and designated landmark. The FEIR/PIR should provide information on additional design changes that occur as a result of consultation with the City of Boston Environmental Department and the Boston Civic Design Commission.

I understand that there are ongoing efforts by the City of Boston to prepare an overall plan for the entire Longwood Medical Area. The FEIR/PIR should provide an update on these activities, and explain how the project fits into the larger context of the City's plan. In addition, the DEIR/PIR notes that the proponent prepared an Institutional Master Plan earlier this year. The FEIR/PIR should discuss the relationship of this specific new

research building project with the overall Institutional Master Plan.

Traffic and Transportation

The DEIR/PIR shows that the level of service (LOS) in the LMA will continue to decline, in some cases to unacceptable levels of E and below. Although the report demonstrates that this decline is not due exclusively to Dana-Farber, the EIR does not describe or commit to adequate mitigation to address the incremental impacts related to the project. For example, the only roadway mitigation discussed involves cooperating with MASCO in its ongoing efforts to improve signal timing and traffic operations within the LMA. The DEIR/PIR notes that "such improvements could lead to improved LOS conditions at signalized intersections." Unfortunately, the DEIR/PIR does not contain any analysis that demonstrates what level of improvement might be expected from such adjustments. Such an analysis should be included in the FEIR/PIR. The FEIR should also contain a summary of the types of improvements that are being considered by MASCO so that there is a context for this discussion on roadway mitigation measures, as well as other non-roadway mitigation measures, as noted below.

The FEIR should contain additional discussion and analysis of particular locations, such as Brookline Avenue and Deaconess Road, where levels of service are expected to fall to unacceptable levels in peak hours in the 1998 scenarios. Again, I note that such deterioration is expected to take place largely due to the scale of overall development in the area and not to any project taken individually. The FEIR should include a discussion of the range of mitigation measures that could be implemented to prevent further decline in the LOS and contain a discussion of Dana-Farber's role in appropriate components of this mitigation.

Particular attention should be paid to the concerns of the MBTA, as expressed in its comments on the DEIR/PIR. The FEIR/PIR should develop an analysis that examines average delay for vehicles traveling to and through the area on the main line roadways. For example, what is the effect on travel time for traffic on Brookline Ave, the main thoroughfare, in 1998 under the build and no-build scenarios? What mitigation measures can be implemented to reduce delay?

While the parking management plan is generally headed in the right direction, improvements could be made to reduce the parking demand. For example, Dana-Farber currently provides a 25%

transit subsidy to employees. The nearby Deaconess Hospital plans to offer 50% transit subsidies by 1998. Consideration should be given to increasing this subsidy. I note that Section 4.2 of the DEIR/PIR summarizes the parking demand management reduction strategies. Notably missing are management reduction incentives that involve adjusting the cost of either on-campus or off-campus parking rates. The FEIR/PIR should consider the impact on demand of adjustments in parking fees. The proponent is encouraged to discuss pricing strategies with the City of Boston Air Pollution Control Commission. The price of parking should be an integral part of a parking demand strategy.

The FEIR should contain a summary of mode splits found at other institutions in the LMA (see DEIR for Harvard Institutes of Medicine, Table III-14 and 15, EOEA #9428). Mode splits at Dana-Farber should be compared to these averages, particularly with respect to employees, rather than visitors.

The trip generation estimates for this project were given for the AM and PM peak hours based on ITE standard rates in addition to rates developed based on project specific data. Page IV-32 notes that the institution specific data (shown as net new vehicle trips) included deductions of estimated trips based on mode split and vehicle occupancy. The FEIR should clarify whether the trip rates were generated based on square footage or number of employees. The differences between the results should be discussed if the number of employees, rather than square footage, was used for estimating trips. The FEIR/PIR should also contain the average daily trip (ADT) estimates.

EIRs for other projects have estimated trip generation in similar ways using institution specific data. The FEIR/PIR should consider the consistency of trip rates between institutions in the LMA and discuss whether an LMA trip rate that is more universally used for such estimates should be developed for future studies.

The DEIR/PIR did a good job describing the potential environmental impacts of this proposed project. The goal of the FEIR/PIR should be to consider ways to achieve higher non-vehicle trip rates and develop a mechanism for monitoring and maintaining these results after project is operational.

Conclusion

I commend the proponent for preparing a responsive and comprehensive environmental document. I look forward to reviewing the Final EIR/PIR. I continue to have concerns about the impact of cumulative development on the Longwood Medical Area. I am pleased that the City is undertaking a comprehensive planning effort for the area. It would be beneficial, I believe, to involve the proponents of the current development proposals, MASCO, the local and state environmental and transportation agencies and other interested parties in a dialogue about long range infrastructure needs and goals for the area. I strongly recommend that a meeting be organized in the near future to discuss the possibility of accelerating the planning process with such additional input.

December 16, 1993
Date

Trudy Coxe
Trudy Coxe

Comments received:
City of Boston Environment Department
Boston Water and Sewer Commission
DEP Air Quality
MBTA
BRA

P:DEIR9452

TC/JD/jd

APPENDIX B

BRA Board Memorandum on the Project dated March 10, 1994

DANA-FARBER
CANCER INSTITUTE

MEMORANDUM MARCH 10, 1994

TO: BOSTON REDEVELOPMENT AUTHORITY AND
MARISA LAGO, DIRECTOR

FROM: BEVERLEY JOHNSON, ASSISTANT DIRECTOR FOR
INSTITUTIONAL PLANNING AND DEVELOPMENT
E. OWEN DONNELLY, DEPUTY DIRECTOR

SUBJECT: PUBLIC HEARING CONCERNING A DEVELOPMENT IMPACT PROJECT PLAN AND AN INSTITUTIONAL MASTER PLAN FOR DANA-FARBER CANCER INSTITUTE AND RELATED ZONING TEXT AND MAP AMENDMENTS.

SUMMARY: This Memorandum requests that the Authority: (1) Approve the Dana-Farber Cancer Institute Institutional Master Plan; (2) Authorize the Executive Director to enter into a Cooperation Agreement with Dana-Farber Cancer Institute in connection with its Institutional Master Plan and Proposed Project; (3) Approve the Development Impact Project Plan ("DIP Plan") submitted by Dana-Farber Cancer Institute in connection with the construction of a New Research Building project at 65 Deaconess Road ("Proposed Project"); (4) Authorize the Executive Director to enter into a Development Impact Project Agreement ("DIP Agreement") with Dana-Farber Cancer Institute in connection with the Proposed Project; (5) Authorize the Executive Director to petition the Zoning Commission to adopt the zoning text and map amendments establishing the Dana-Farber Cancer Institute Institutional District; and (6) Authorize the Executive Director to issue an Adequacy Determination for the Proposed Project upon completion of the Authority's Article 31 development review process.

Introduction

The Dana-Farber Cancer Institute operates a facility for research into the causes, treatment, and prevention of cancer and other diseases in children and adults. The Institute carries out research, study, teaching, clinical investigation, care of patients, and training of medical students, scientists, nurses, research assistants, and paramedical personnel. The Institute's campus is located at the corner of Deaconess Road and Binney Street on the easterly side of Brookline Avenue within the Longwood Medical Area (LMA). The surrounding LMA is characterized by medical institutions

and health care-related uses. The Institute has identified a need for new research space in order to accommodate the Institute's focus on patient care research.

The Institute requests approval of a Development Impact Project Plan and a Development Impact Project Agreement for the construction of the Proposed Project at 65 Deaconess Road. The Institute also requests the approval of a Cooperation Agreement and the Dana-Farber Cancer Institute Institutional Master Plan and issuance of an Adequacy Determination for the Proposed Project. In addition, the Institute requests approval of zoning text and map amendments as proposed by the BRA that would establish the Dana-Farber Cancer Institute Institutional District.

Project Description

Dana Farber Cancer Institute proposes to build a new research facility on its campus at 65 Deaconess Road. The 28.845 square foot site is located at the corner of Deaconess Road and Binney Street. All of the uses abutting the site are institutional. The building will house cancer research laboratories and necessary support facilities.

The Proposed Project will have a gross floor area of approximately 214,000 gross square feet in a building of 11 occupied and two mechanical floors above-grade. The height of the building will be approximately 184 feet above grade. Six parking levels below grade will accommodate approximately 246 vehicles. Access to the parking garage will be from Deaconess Road.

Urban Design

The Proposed Project has been substantially improved through the design review process. The Institute initially presented a building footprint which built out the Site from lot line to lot line, and included two overhead bridges connecting to the Institute's Dana Building and to the Brigham & Women's Hospital. Following review with Authority urban design staff, the building's perceived mass was reduced by notching out the corners of the building and stepping the building back at the top two floors. The building was also stepped back at the two lower floors to provide additional sidewalk area with an arcade along Deaconess Road and Binney Street. In subsequent meetings with the Boston Civic Design Commission (BCDC), additional changes were incorporated into the design. The building was moved back an additional 15 feet from Binney Street, providing a 19.5-foot sidewalk, and the bridge over Binney Street connecting to Brigham & Women's Hospital was eliminated from the program and was replaced with a new bridge to the Jimmy Fund Building. The arcade along Deaconess Road was maintained. Furthermore, one floor has been removed from the project reducing the height by 10 feet and the floor area by 23,000 square feet. The floor area ratio of the contiguous Dana-Farber property has been reduced to 5.17. The BCDC recommended approval of the schematic design plan on March 8, 1994. The current site plan and elevations are shown in the attached exhibits.

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Institutional Zoning

Zoning text and map amendments are proposed in order to create new zoning controls for the area that includes the campus of the Dana-Farber Cancer Institute. The goal of the proposed zoning is to permit institutional growth in a manner compatible with the surrounding area, as reflected in an Institutional Master Plan. The proposed zoning, which would establish the Dana-Farber Cancer Institute Institutional District in place of the existing H-3 and L-1 districts, follows closely the institutional master planning provisions recently adopted by the Authority and the Zoning Commission for the Beth Israel Hospital Institutional District, the Massachusetts College of Pharmacy Institutional District, and the New England Deaconess Hospital Institutional District, as well as the zoning plan being prepared for the Longwood Medical Area. New institutional development would be subject to the Institutional Master Plan requirement of the proposed zoning. This would require an institution to prepare an Institutional Master Plan describing its future development program. The Institutional Master Plan must be approved by the Authority and the Zoning Commission, after public hearings, prior to the construction of any project described in an Institutional Master Plan.

In addition to establishing the Institutional Master Plan requirement, the proposed zoning establishes underlying use and dimensional controls to govern projects that are not subject to Institutional Master Plan approval. Projects that do require Institutional Master Plan approval are governed by the use, dimensional, and parking and loading requirements that are approved in the Institutional Master Plan.

The proposed Institutional District is the fourth Institutional District zoning article to be proposed during the planning process for the Longwood Medical Area. Like its predecessors (the Beth Israel Hospital Institutional District, the Massachusetts College of Pharmacy Institutional District, and the New England Deaconess Hospital Institutional District), the proposed Institutional District is designed to meet the need for new zoning controls to govern institutional growth until comprehensive zoning regulations for the entire Longwood Medical Area have been developed. Upon completion of the area-wide planning and public review processes, the zoning regulations for the entire Longwood Medical Area will replace those previously developed for the individual Institutional Districts.

Institutional Master Plan

Dana-Farber's Institutional Master Plan, entitled "Dana-Farber Cancer Institute Institutional Master Plan, 1993-2001" (the "Master Plan"), has been prepared to describe anticipated development over the next eight-year period to the year 2001. The projects described in the Master Plan include a project (the "Proposed Project") to construct a new research building of approximately 213,592 gross square feet (for floor area ratio purposes) on the site of the existing Frederika Building and surface parking lot at the corner of Deaconess Road and Binney Street. The Frederika

Building and a small garage structure on-site will be demolished to allow for construction of the Proposed Project. The Proposed Project will provide facilities that will support the research needs of the Institute. The Proposed Project will include space for laboratory research and research support. The Proposed Project will also include bridges connecting the facility to the Institute's existing Dana and Jimmy Fund Buildings. A below-grade, approximately 246-space parking garage will also be constructed.

Article 31 Development Review

On May 17, 1993, the Institute voluntarily submitted to the BRA a Project Notification Form (PNF) for Article 31 development review of the Proposed Project. BRA staff issued a Scoping Determination on July 21, 1993 that addressed issues associated with the Proposed Project. The Institute responded on November 1, 1993 by submitting a joint Draft Project Impact and Environmental Impact Report (the "Joint Draft Report") as directed by the BRA and the Executive Office of Environmental Affairs MEPA Unit. The Preliminary Adequacy Determination, which will be issued in the near future, reflects the BRA staff's review of the joint Draft Report and concludes that environmental and other mitigation strategies have been sufficiently addressed to proceed with obtaining BRA approval of the Proposed Project.

Community Review

In accordance with the requirements of Article 31, formal presentations were made to the Mission Hill Planning and Zoning Advisory Committee (PZAC) in November 1993 and March 1994. The Mission Hill PZAC has not formally voted to support the Proposed Project and the Institutional Master Plan.

Community Benefits

The Institute is providing a comprehensive community benefits package that includes Housing Linkage of $567,960 and Jobs Linkage of $113,592. The Proposed Project will also provide up to 200 temporary construction jobs and 500 new permanent jobs. The Institute will work with the local community and City agencies to develop a job creation proposal to serve the residents of the local community that coordinates with other LMA employment and training initiatives using the job linkage funds from the Proposed Project. The Institute will offer current employees from the local community skills upgrading opportunities. The Institute will offer new employment opportunities to qualified community residents. The institute will seek to increase the number of employees from the local community and to work with appropriate people in the community to accomplish this objective. The Institute will distribute notices of available positions on a regular basis to locations to be agreed upon by the community. In addition, a PILOT payment in the amount of $65,775 has been negotiated with the City of Boston Assessing Department.

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Transportation Access Plan Agreement

The Proposed Project has been reviewed by the Boston Transportation Department (BTD). A Transportation Access Plan Agreement ("TAP Agreement") is being prepared and includes mitigation measures and provisions for the Proposed Project. A TAP Agreement satisfactory to the Commissioner of BTD will be executed prior to the issuance of a building permit for the construction of the Proposed Project.

Conclusion

BRA staff recommends that the Authority: (1) Approve the Dana-Farber Cancer Institute Institutional Master Plan; (2) Authorize the Executive Director to enter into a Cooperation Agreement with the Dana-Farber Cancer Institute and other agreements required by or incidental to the Cooperation Agreement; (3) Approve the Development Impact Plan ("DIP Plan") submitted by the Dana-Farber Cancer Institute in connection with the Proposed Project; (4) Authorize the Executive Director to enter into a Development Impact Project Agreement ("DIP Agreement") with the Dana-Farber Cancer Institute in connection with the Proposed Project; (5) Authorize the Executive Director to petition the Zoning Commission to adopt the zoning text and map amendments establishing the Dana-Farber Cancer Institute Institutional District; and (6) Authorize the Executive Director to issue an Adequacy Determination for the Dana-Farber Cancer Institute New Research Building Project upon completion of the Authority's Article 31 process.

Appropriate votes follow:

VOTED: That the Boston Redevelopment Authority approves the Dana-Farber Cancer Institute Institutional Master Plan presented to the Authority at its hearing on March 10, 1994, and authorize the Executive Director to petition the Zoning Commission to adopt a zoning map amendment depicting the Dana-Farber Cancer Institute Institutional Master Plan area in substantial accord with the map amendment submitted to the Authority at its hearing on March 10, 1994; and further

VOTED: That with respect to the Cooperation Agreement presented to the Authority at its hearing on March 10, 1994 (the "Cooperation Agreement"), the Boston Redevelopment Authority authorizes the Executive Director, in the name and on behalf of the Authority, to execute and deliver: (1) the Cooperation Agreement substantially in the form presented at the Authority's March 10, 1994 hearing subject to such revisions deemed necessary and appropriate by the Executive Director, and (2) all other agreements and documents required by or incidental to the Cooperation Agreement; and further

VOTED: That with respect to the Proposed Project at 65 Deaconess Road (the "Proposed Project") presented to the Boston Redevelopment Authority at its public hearing on March 10, 1994 by the Dana-Farber Cancer Institute, the Boston Redevelopment Authority hereby issues the following findings, approvals, and authorizations:

(1) With respect to the requirements of Articles 26 through 26B (Development Impact Projects) of the Boston Zoning Code, as amended:

(a) The Boston Redevelopment Authority, after due consideration of the evidence presented at the Authority's public hearing on March 10, 1994, finds that the Development Impact Project Plan presented at said hearing (the "DIP Plan"): (i) conforms to the general plan for the City of Boston as a whole; (ii) contains nothing that will be injurious to the neighborhood or otherwise detrimental to the public welfare; and (iii) does adequately and sufficiently satisfy all other requirements of Articles 26 through 26B for a Development Impact Project Plan; and further

(b) The Boston Redevelopment Authority approves the DIP Plan presented at the Authority's March 10, 1994 hearing. Said DIP Plan is embodied in a written document entitled "Development Impact Project Plan for the Dana-Farber Cancer Institute" and exhibits thereto; and further

(c) The Boston Redevelopment Authority authorizes the Executive Director, in the name and on behalf of the Authority:

(i) To execute and deliver: (1) a Development Impact Project Agreement in the form presented at the Authority's March 10, 1994 public hearing, subject to such revisions deemed necessary and appropriate by the Executive Director (the "DIP Agreement"), and (2) any other agreements with Dana-Farber Cancer Institute required by or incidental to the DIP Agreement; and

(ii) To certify: (1) that plans submitted to the Inspectional Services Department in connection with the Proposed Project conform to the DIP Plan, at such time as the Executive Director, in his discretion, determines that such plans so conform; and (2) that Dana-Farber

Cancer Institute has entered into a DIP Agreement with the Authority that meets all of the requirements of Articles 26 through 26B of the Boston Zoning Code, as amended; and further

(2) With respect to Development Review of the Proposed Project under Article 31 of the Boston Zoning Code, as amended, the Boston Redevelopment Authority authorizes the Executive Director to issue an Adequacy Determination upon completion of the Authority's Article 31 process, provided that the final design review approval shall not be granted prior to the execution of a Transportation Access Plan Agreement for the Dana-Farber Cancer Institute Research Building (the "TAP Agreement"), and provided further that Dana-Farber Cancer Institute shall enter into a Boston Residents Construction Employment Plan, a Memorandum of Understanding, a First Source Agreement, and other necessary agreements with the Mayor's Office of Jobs and Community Services with respect to the Proposed Project; and further

(3) The Boston Redevelopment Authority authorizes the Executive Director to certify, in the name and on behalf of the Authority, that the plans submitted to the Inspectional Services Department in connection with the Proposed Project are consistent with the description of such Proposed Project in the Dana-Farber Cancer Institute Institutional Master Plan at such time as the Executive Director, in his discretion, determines that such plans are so consistent; and further

VOTED: That the Boston Redevelopment Authority authorizes the Executive Director to petition the Zoning Commission to adopt Article 73 and a related map amendment establishing the Dana-Farber Cancer Institute Institutional District, in substantial accord with the text and map amendments submitted to the Authority at its hearing on March 10, 1994; and further

VOTED: That any agreements or other documents executed by the Executive Director on behalf of the Boston Redevelopment Authority pursuant to the authority granted by the foregoing votes shall include such terms and conditions as the Executive Director deems appropriate and in the best interests of the Authority, the Executive Director's execution and delivery of such agreements and other documents to be conclusive evidence of the Executive Director's determination and of the authorization granted to him hereunder. All agreements, plans, and other documents approved by the Boston Redevelopment Authority, or

executed by its Executive Director, pursuant to such votes, shall be on file in the office of the Boston Redevelopment Authority.

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APPENDIX C

Zoning Amendments
Text and Map

DANA-FARBER
CANCER INSTITUTE

Text Amendment Application No. 241
Boston Redevelopment Authority
Dana-Farber Cancer Institute
Institutional District

TEXT AMENDMENT NO. 208

EFFECTIVE
April 8, 1994*

THE COMMONWEALTH OF MASSACHUSETTS

CITY OF BOSTON

IN ZONING COMMISSION

The Zoning Commission of the City of Boston, acting under Chapter 665 of the Acts of 1956 as amended, after due report, notice, and hearing does hereby amend the Boston Zoning Code as follows:

By inserting, after Article 72, the following article:

ARTICLE 73

DANA-FARBER CANCER INSTITUTE INSTITUTIONAL DISTRICT

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* Date of public notice: March 18, 1994 (see St. 1956, c. 665, s. 5).

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REGULATIONS GOVERNING DEVELOPMENT REVIEW AND DESIGN REVIEW

MISCELLANEOUS PROVISIONS

SECTION 73-1. **Statement of Purpose**. The purpose of this Article is to establish zoning regulations for the review and approval of projects for major institutional uses in the context of long-term institutional development plans within the area governed by this Article. The goal of these regulations is to provide for the well-planned development of institutions and to enhance their public service and economic development role in the surrounding neighborhoods; to encourage economic growth and the diversification of Boston's economy, with special emphasis on creating and retaining job opportunities; to preserve, enhance and create open space; to protect the environment and improve the quality of life; to promote the most desirable use of land; and to promote the public safety, health, and welfare of the people of Boston.

SECTION 73-2. **Physical Boundaries**. The provisions of this Article apply to: (1) land and structures located within the Dana-Farber Cancer Institute Institutional District, and (2) land and structures located outside such Institutional District but described in an Institutional Master Plan approved from time to time in accordance with the provisions of this Article. The land referred to in (1) and (2) above is collectively referred to as the Dana-Farber Cancer Institute Institutional Master Plan Area. The Institutional Master Plan Area is applicable on an overlay basis and may include non-contiguous elements within or outside the Dana-Farber Cancer Institute Institutional District. The boundaries of the Dana-Farber Cancer Institute Institutional District are as shown on the map entitled "Map 1 Boston Proper" of the series of maps entitled "Zoning Districts City of Boston," as amended from time to time.

SECTION 73-3. **Applicability**. This Article, together with the rest of this Code, constitutes the zoning regulation for the Dana-Farber Cancer Institute Institutional District, and together with the provisions of an applicable Institutional Master Plan, constitute the zoning regulation for the Dana-Farber Cancer Institute Institutional Master Plan Area. The zoning regulations for such Institutional District and Institutional Master Plan Area apply as specified in Section 4-1 regarding the conformity of buildings and land to this Code. Zoning relief in the form of exceptions from the provisions of this Article pursuant to Article 6A is not available, except to the extent expressly provided in this Article or in Article 6A. Where conflicts exist between the provisions of this Article and the remainder of the Code, the provisions of this Article shall govern. Except where specifically indicated to the contrary in this Article, the provisions of this Article supersede Section 8-7, Articles 13 through 24, and Article 27M of this Code for the Dana-Farber Cancer Institute Institutional District. Any Proposed Institutional Project that is required to be consistent with an applicable Institutional Master Plan shall be deemed to be a project for which zoning relief is required for the purposes of Articles 26, 26A, and 26B.

Proposed Projects are exempt from the provisions of this Article, and are governed by the rest of this Code, if application to the Inspectional Services Department for a building or use permit has been made prior to the first notice of hearing before the Zoning Commission for adoption of this Article, and (1) no Zoning Relief is required, or (2) any required Zoning Relief has been or thereafter is granted by the Board of Appeal; provided that construction work under such building permit, or occupancy under such occupancy permit, as the case may be, is commenced within six (6) months of the date of such permit and proceeds in good faith continuously to completion so far as is reasonably practicable under the circumstances.

Notwithstanding any contrary provision of this Code, any Institutional Use existing within the Dana-Farber Cancer Institute Institutional District as of the date of the first notice of hearing before the Zoning Commission for the adoption of this Article shall be deemed allowed for all purposes under this Code, whether or not described in an Institutional Master Plan and without need for a determination of consistency with such an Institutional Master Plan pursuant to Section 73-11.

Any building or structure existing within the Dana-Farber Cancer Institute Institutional District as of the date of the first notice of hearing before the Zoning Commission for the adoption of this Article and:

(i) used for an Institutional Use as of such date, or

(ii) adequately described in an applicable Institutional Master Plan in accordance with Section 73-8(b)

shall be deemed to be in compliance, as so existing, with the dimensional, parking, and loading requirements of this Article and shall not be considered dimensionally nonconforming for the purposes of Article 9.

SECTION 73-4. **Prohibition of Planned Development Areas.** No Planned Development Area shall be permitted for any Proposed Project to which the Institutional Master Plan requirement of Section 73-7 applies.

USE AND DIMENSIONAL REGULATIONS

SECTION 73-5. **Use Regulations**. Except as otherwise specifically provided in this Article, no land or structure within the Dana-Farber Cancer Institute Institutional District shall be erected, used, or arranged or designed to be used, in whole or in part, unless, for the proposed location of such use, the use is identified in Table A of this Article as "A" (allowed) or as "C" (conditional). Any use identified as conditional in Table A is subject to the provisions of Article 6. Any use identified as "F" (forbidden) in Table A for the proposed location of such use is forbidden in such location. Any use not included in Table A is forbidden in the Dana-Farber Cancer Institute Institutional District.

SECTION 73-6. **Dimensional Regulations**. Except as otherwise specifically provided in this Article, the dimensional requirements governing land and structures in the Dana-Farber Cancer Institute Institutional District are as set forth in Table B of this Article.

REGULATIONS APPLICABLE TO INSTITUTIONAL USES

SECTION 73-7. **Institutional Master Plan Requirement.**

1. Applicability of Requirement. The Inspectional Services Department shall not issue a building, use, or occupancy permit for any Proposed Institutional Project governed by the provisions of this Article for the erection, extension, or alteration of any structure or part thereof, or the change of use of any structure or land, that is (or immediately after completion will be) used or occupied for an Institutional Use, unless such Proposed Institutional Project is:

   (a) consistent with an Institutional Master Plan, pursuant to Section 73-11; or

   (b) exempt from such Institutional Master Plan requirement, pursuant to Subsection 73-7.2.

2. Exempt Projects. Within the Dana-Farber Cancer Institute Institutional District, a Proposed Institutional Project is exempt from the Institutional Master Plan requirement of this Article if it is:

   (i) for interior alterations to an existing building, provided that such Proposed Institutional Project does not involve the establishment or expansion of a High Impact Subuse or ambulatory clinical care facility that will affect, after such establishment or expansion, an aggregate gross floor area of more than fifty thousand (50,000) square feet (which area is not a phase of another Proposed Institutional Project); or

   (ii) for the erection or extension of an Institutional Use, provided that such Proposed Institutional Project does not affect an aggregate gross floor area of more than twenty thousand (20,000) square feet (which area is not a phase of another Proposed Institutional Project).

   (a) Applicable Regulations. A Proposed Institutional Project that is exempt from the Institutional Master Plan requirement of this Article, pursuant to this Section 73-7, and not electively described in an Institutional Master Plan, pursuant to paragraph (c) of this Subsection 73-7.2, shall be governed by the use, dimensional, and other regulations of this Code applicable to the use category, other than an Institutional Use, that most closely describes such project, except that such project shall not be subject to the maximum floor area ratio (FAR) requirement of such regulations.

(b) Notice. If the proponent of a Proposed Institutional Project believes that such Proposed Institutional Project is exempt from the Institutional Master Plan requirement of this Article, pursuant to this Section 73-7, the proponent shall file written notice to the Inspectional Services Department and the Boston Redevelopment Authority setting forth the reasons why such project is exempt from such requirement. Such notice shall be filed at the time a building or use permit application for such Proposed Institutional Project is filed with the Inspectional Services Department.

(c) Election to Include Exempt Project in Institutional Master Plan. An applicant for an Institutional Master Plan approval, renewal, or amendment may elect, in its submission materials, to make any exempt project subject to the provisions of its Institutional Master Plan, in which event such Proposed Institutional Project shall be governed by the provisions of this Article, notwithstanding any contrary provision of this Section 73-7.

3. Exemption for Smaller Institutions. Notwithstanding any contrary provision of this Section 73-7, the provisions of this Article shall not apply to a Proposed Institutional Project if the combined gross floor area of the Proposed Institutional Project and all of the other Institutional Uses of the same Institution is less than one hundred fifty thousand (150,000) square feet; provided, however, that the Institution may elect to seek approval of an Institutional Master Plan, and as of the date of such approval, the Institutional Uses of the Institution shall be subject to the provisions of this Article.

4. Special Provisions Applicable to High Impact Subuses and Ambulatory Care Facilities. Notwithstanding any contrary provision of Article 2A, the location of any Proposed Institutional Project for: (i) a High Impact Subuse; or (ii) ambulatory clinical care facilities must be consistent with that specified in an applicable Institutional Master Plan. A "High Impact Subuse" means a subuse of an Institutional Use that is identified as a High Impact Subuse in the definition of such Institutional Use set forth in Article 2A.

5. Appeals. Any applicant aggrieved by the denial of any permit by the Inspectional Services Department pursuant to this Section 73-7 may appeal to the Board of Appeal within forty-five (45) days after such denial of a permit, in accordance with the provisions of Article 6.

SECTION 73-8. **Content of Institutional Master Plans**. An Institutional Master Plan shall include the elements described in this Section 73-8 to provide a basis for evaluating, for city planning purposes, the impact on the surrounding neighborhoods of

the Institution's current and future projects. The Institutional Master Plan shall project its proposed development plan at least eight (8) years into the future, commencing from the date of submission of the Institutional Master Plan, and shall include within the Plan all currently planned Proposed Institutional Projects that are not exempt under Section 73-7 and any projects that are electively included in the Institutional Master Plan. In addition, the Plan shall set out and define the longer term goals of the Institution, a minimum of ten (10) years into the future. These goals should address the broad direction to be taken by the Institution with regard to its growth and services. An Institutional Master Plan prepared pursuant to this Article shall cover the current and proposed properties, uses, and activities of the Institution within the areas of the City where preparation of an Institutional Master Plan is required. Each Institutional Master Plan shall include each of the following elements, except to the extent waived by the Boston Redevelopment Authority, as determined in the Scoping Determination described in Section 73-9.2:

(a) Mission and Objectives

A statement which defines the organizational mission and objectives of the Institution, and a description of how all development contemplated or defined by the Institutional Master Plan advances the goals and objectives of the Institution. The statement should describe the population to be served by the Institution, and any projected changes in the size or composition of that population. It should also specify any services to be provided to Boston residents in adjacent neighborhoods and in other areas of the City.

(b) Existing Property and Uses

A description of land, buildings, and other structures occupied by Institutional Uses of the Institution as of the date of submission of the Institutional Master Plan, with such information including, for each property, the following: (i) illustrative site plans showing the footprints of each building and structure, together with roads, sidewalks, parking, and other significant improvements; (ii) land and building uses; (iii) building gross square footage; (iv) building height in stories and, approximately, in feet; (v) a description of off-street parking and loading areas and facilities, including a statement of the approximate number of parking spaces in each area or facility; and (vi) existing building linkage payments.

(c) Needs of the Institution

A summary and projection of the Institution's current and future needs for the following facilities: (i) academic; (ii) service; (iii) research; (iv) office; (v) housing; (vi) patient care; (vii) public assembly; (viii)

parking; and other facilities related to the Institutional Use. Such needs shall be defined in relationship to the Institution's goals and objectives as previously described.

(d) Proposed Future Projects

A description of any proposed future projects of the Institution within the areas of the City where preparation of an Institutional Master Plan is required (other than projects that are exempt under Section 73-7 and not electively included in the Institutional Master Plan) and their relationship to present and future needs. The required descriptions may include:

(i) site locations and approximate building footprints;

(ii) uses (specifying the principal subuses of each land area, building, or structure, such as classroom, laboratory, parking facility);

(iii) square feet of gross floor area;

(iv) square feet of gross floor area eliminated from existing buildings through demolition of existing facilities;

(v) floor area ratios;

(vi) building heights;

(vii) parking areas or facilities to be provided in connection with proposed projects;

(viii) any applicable urban renewal plans, land disposition agreements, or the like;

(ix) current zoning of sites;

(x) total project cost estimates;

(xi) estimated development impact payments;

(xii) approximate timetable for development of Proposed Institutional Projects, with the estimated month and year of construction start and construction completion for each.

(e) Institutional Transportation and Parking Management and Mitigation Plan

A description of the Institution's existing transportation and parking characteristics, a description of parking to be provided over the term of the Institutional Master Plan, a projection of impacts associated with the projects proposed in the Institutional Master Plan, and a set of transportation goals and mitigation measures to address these impacts.

(f) Pedestrian Circulation Guidelines and Objectives

A statement of guidelines and objectives for pedestrian circulation system to be provided through the campus of the Institution, including guidelines and objectives regarding the accessibility to the general public of any pedestrian areas and open spaces.

(g) Urban Design Guidelines and Objectives

A statement of urban design guidelines and objectives for new and renovated buildings to assure their compatibility with supporting neighborhoods and districts and to minimize potential adverse impacts on historic structures.

(h) Job Training Analysis

A description of the Institution's current workforce and projected future employment needs in connection with future projects and a description of current and/or proposed programs with Boston schools and other programs to train and employ students from Boston, and particularly from neighborhoods in the vicinity of the Institution, at the requisite skill levels.

(i) Community Benefits Plan

An identification of community benefits that mitigate impacts of proposed future projects or otherwise are appropriate to and enhance the surrounding communities.

(j) Additional Elements

Such additional elements as the Boston Redevelopment Authority shall determine are necessary adequately to describe and to evaluate the Institution's proposed development program.

SECTION 73-9. **Approval of Institutional Master Plans by the Boston Redevelopment Authority.** No Institutional Master Plan shall be approved by the Boston Redevelopment Authority, except in conformity with the provisions of this Section 73-9.

1. Institutional Master Plan Notification Form. The Institution seeking an Institutional Master Plan approval shall commence the process by filing an Institutional Master Plan Notification Form (IMPNF) in writing with the Boston Redevelopment Authority.

   (a) Content of IMPNF. An IMPNF shall consist of those elements of an Institutional Master Plan identified in paragraphs (a) and (d) of Section 73-8, and, if the Institution is planning one or more Proposed Institutional Projects, the IMPNF also shall include summary statements of anticipated impacts of such projects in the impact areas identified in Sections 31-6 through 31-10.

   (b) Public Notice and Comment. Within five (5) days after submission of an IMPNF to the Boston Redevelopment Authority, the Boston Redevelopment Authority shall publish notice of such submission in one or more newspapers of general circulation in the city, such notice to state the name of the Institution and to identify the area to which the Institutional Master Plan will apply, and shall make copies of the IMPNF available to the public. Public comments, including the comments of public agencies, shall be transmitted in writing to the Boston Redevelopment Authority within twenty (20) days of such notice.

2. Scoping Determination. Based on the Boston Redevelopment Authority's review of public comments and the IMPNF, the Boston Redevelopment Authority shall issue a written Scoping Determination setting forth in sufficient detail those elements set forth in Section 73-8 that are to be included in the Institutional Master Plan. Such Scoping Determination shall be issued no later than thirty (30) days after the Institution files an IMPNF.

3. Institutional Master Plan. The Institution shall satisfy the requirements of the Scoping Determination in the preparation of an Institutional Master Plan. Within five (5) days after submission of the Institution's Institutional Master Plan to the Boston Redevelopment Authority, the Boston Redevelopment Authority shall publish notice of such submission in one or more newspapers of general circulation in the city, such notice to state the name of the Institution and to identify the area to which the Institutional Master Plan will apply and shall make copies of the Institutional Master Plan available to the public. Public comments, including the comments of

public agencies, shall be transmitted in writing to the Boston Redevelopment Authority within sixty (60) days of such notice.

4. Adequacy Determination. After the public hearing required by Section 73-9.7, and based on the Boston Redevelopment Authority's review of public comments and the Institutional Master Plan, the Boston Redevelopment Authority shall issue a written Adequacy Determination within ninety (90) days after the submission of said Institutional Master Plan to the Boston Redevelopment Authority.

   In issuing an Adequacy Determination, the Boston Redevelopment Authority shall approve the Institutional Master Plan, conditionally approve the Institutional Master Plan, or disapprove it in whole or in part. If all or any part of the Institutional Master Plan is disapproved, specific reasons setting forth the areas in which the Institutional Master Plan is at variance with the requirements of the Scoping Determination or this Article shall be provided in the Adequacy Determination. An Adequacy Determination which, in whole or in part, conditionally approves or disapproves the Institutional Master Plan may require additional elements, information, studies, and mitigation measures, provided that such requirements are within the breadth of the Scoping Determination and the provisions of this Article.

5. Revised Institutional Master Plan. If the Boston Redevelopment Authority's Adequacy Determination disapproves the Institution's Institutional Master Plan, the Institution shall revise the Institutional Master Plan prior to resubmission. The revised and resubmitted Institutional Master Plan shall be reviewed in the manner provided in, and subject to the requirements of, subsections 3 and 4 of this Section 73-9.

6. Time Extensions for Determinations. The Boston Redevelopment Authority may, by notifying the Institution in writing, extend the time periods set out in this Section 73-9.6 for issuing a Scoping Determination and an Adequacy Determination if it finds that: (a) additional time is necessary to render a determination because of the complexity of the IMPNF or of the Institutional Master Plan; or (b) additional time is necessary for the public, including public agencies, to review and comment on the IMPNF or the Institutional Master Plan.

   No more than one extension of time may be exercised in connection with the issuance of a Scoping Determination or an Adequacy Determination, and no extension of time for the issuance of a Scoping Determination or an Adequacy Determination shall exceed thirty (30) days.

7. Community Participation.

(a) Copies of Institutional Master Plan. The Institution shall provide the Boston Redevelopment Authority with a sufficient number of copies (up to fifty (50)), as requested by the Boston Redevelopment Authority, of the IMPNF, the Institutional Master Plan, and any revised Institutional Master Plan to allow for distribution to interested parties. The Boston Redevelopment Authority shall make copies of the IMPNF, the Institutional Master Plan, and any revised Institutional Master Plan available generally to the public within five (5) days after such materials have been submitted to the Boston Redevelopment Authority.

(b) Public Hearing. The Boston Redevelopment Authority shall hold a public hearing prior to approving an Institutional Master Plan, or an amendment or renewal thereof, except that: (i) no public hearing shall be required for a renewal or amendment that satisfies the requirements of Section 73-12.3(a) (Review of Unchanged Plans), and (ii) the Boston Redevelopment Authority may at its discretion require a public hearing for an amendment or renewal that satisfies the requirements of Section 73-12.3(b) (Expedited Review of Amendment Adding Certain Small Projects).

Prior to issuing its Scoping Determination for the review of an Institutional Master Plan or an amendment or renewal thereof, the Boston Redevelopment Authority may schedule a public consultation session to review the proposal and discuss potential impacts.

8. Standards for Institutional Master Plan Approval. An Institutional Master Plan shall be approved by the Boston Redevelopment Authority only if the Boston Redevelopment Authority finds that: (a) the Institutional Master Plan conforms to the provisions of this Article; (b) the Institutional Master Plan conforms to the general plan for the city as a whole; (c) on balance, nothing in the Institutional Master Plan will be injurious to the neighborhood or otherwise detrimental to the public welfare, weighing all the benefits and burdens.

9. Coordination with Other Development Review.

(a) Article 31 Development Review. In reviewing, pursuant to Article 31, a Proposed Institutional Project that is subject to the provisions of Section 73-7 the Boston Redevelopment Authority shall:

(i) require in its Scoping Determination under Article 31 that the Project Impact Report address the cumulative impacts

associated with the Proposed Institutional Project when added to the Institution's existing Institutional Uses and the other Proposed Institutional Projects identified in the Institution's Master Plan; and

(ii) limit its Scoping Determination under Article 31 to those issues not already satisfactorily examined in the context of the Institutional Master Plan; and

(iii) include in its Scoping Determination and review under Article 31, at the request of the Applicant, the Development Impact Project Plan required by the applicable provisions of Article 26, Article 26A, and Article 26B, and the issues raised thereby, if the Applicant has submitted such Development Impact Project Plan to the Boston Redevelopment Authority together with the Project Impact Report required by Article 31; and

(iv) limit any mitigation measures or project modifications required as a result of development review under Article 31 to those necessary to mitigate or address adverse impacts of the Proposed Project identified in the Article 31 development review process.

(b) <u>Development Impact Projects: Articles 26, 26A, and 26B</u>. The Boston Redevelopment Authority shall review any Development Impact Project Plan required by the applicable provisions of Articles 26, 26A, and 26B for a Proposed Institutional Project (i) as part of the approval, amendment, or renewal of an applicable Institutional Master Plan pursuant to Section 73-9 or (ii) as part of the development review of such Proposed Institutional Project pursuant to Article 31, if the Applicant has submitted such Development Impact Project Plan to the Boston Redevelopment Authority together with such Institutional Master Plan or Article 31 Project Impact Report, as the case may be. Such procedure shall not limit or modify any of the substantive or procedural requirements of Articles 26, 26A, or 26B.

A Development Impact Project Plan prepared pursuant to Article 26, Article 26A, or Article 26B for a Proposed Institutional Project may incorporate by reference those portions of an applicable Institutional Master Plan that are pertinent to the requirements of Section 26-2.2, 26A-2.2, or 26B-2.2, as the case may be.

(c) <u>Joint Institutional Projects</u>. A Proposed Institutional Project involving the participation of more than one Institution (and not otherwise

exempt from the Institutional Master Plan requirement of Section 73-7, pursuant to Section 73-7.2) shall be included in its entirety in the Institutional Master Plan for one of such Institutions, or the relevant part of a Proposed Institutional Project shall be included in the Institutional Master Plan for each such Institution, pursuant to this Section 73-9 (Approval of Institutional Master Plans).

(i) Projects in Single Institutional Master Plan. If a Proposed Institutional Project is included in its entirety in a singe Institutional Master Plan, the Institutional Master Plan shall disclose the identity and extent of participation of each participating Institution, to the extent that such information can be ascertained at the time of approval of the Institutional Master Plan and each of its subsequent updates, amendments, and renewals.

(ii) Projects in More than One Institutional Master Plan. If a Proposed Institutional Project is included in the Institutional Master Plan for two or more Institutions, the Boston Redevelopment Authority, at the request of such Institutions, shall:

(1) allow the submission of a combined IMPNF for such project incorporating all the information required from all such Institutions;

(2) provide for the required Institutional Master Plan amendments to be reviewed together, to the extent feasible, at any public meetings and public hearings required pursuant to this Section 73-9; and

(3) limit the scope of review of such Proposed Institutional Project in each Institution's Institutional Master Plan to those portions of such project that involve the participation of that Institution.

10. Appeals. An applicant aggrieved by the issuance of an Adequacy Determination by the Boston Redevelopment Authority disapproving or conditionally approving an Institutional Master Plan pursuant to this Section 73-9 or an amendment or renewal thereof pursuant to Section 73-12 may appeal to the Board of Appeal within forty-five (45) days after the issuance of such Adequacy Determination, in accordance with the provisions of Article 6.

SECTION 73-10. **Zoning Commission Approval.** Upon approval of the Institutional Master Plan by the Boston Redevelopment Authority, the Boston Redevelopment Authority shall transmit the Institutional Master Plan to the Zoning Commission for its consideration.

The Institutional Master Plan entitled "Dana-Farber Cancer Institute Institutional Master Plan, 1993-2001" dated "March 1994" and approved by the Boston Redevelopment Authority on March 10, 1994, shall be deemed approved hereunder as though such Institutional Master Plan had been approved pursuant to the provisions of this Article and Code.

SECTION 73-11. **Consistency with an Institutional Master Plan**. The Department of Inspectional Services shall not issue a building, use or occupancy permit for any Proposed Project that is subject to the provisions of Section 73-7 (and that is not exempt from such provisions by the terms thereof) for the erection, extension, or alteration of any structure or part thereof, or the change of use of any structure or land, unless the Director of the Boston Redevelopment Authority certifies that the Proposed Project is adequately described in an applicable Institutional Master Plan and is consistent with such applicable Institutional Master Plan. Such certification of consistency, or a finding of inconsistency, or a finding of consistency subject to a condition or conditions, shall be issued within sixty (60) days after the Boston Redevelopment Authority has received from the Inspectional Services Department a copy of an application for a building, use, or occupancy permit for the Proposed Project.

Prior to making a certification of consistency, the Director of the Boston Redevelopment Authority may require the Applicant to submit information and materials as necessary to evaluate whether the Proposed Institutional Project is consistent with the Institutional Master Plan. Provided that such updated materials and information do not alter or require alteration of the development program proposed in the Institutional Master Plan or of proposed mitigation measures, such updated materials and information shall not be deemed to be an amendment to the Institutional Master Plan.

An Institution aggrieved by the denial of any permit by the Department of Inspectional Services pursuant to this Section 73-11 may appeal to the Board of Appeal within forty-five (45) days after such denial of a permit, in accordance with the provisions of Article 6.

Any use or structure that is adequately described in an Institutional Master Plan and is consistent with such Institutional Master Plan, as certified in accordance with this Section 73-11, and that has satisfied any applicable requirements of Article 31, shall be deemed to be in compliance with the use, dimensional, parking and loading requirements of this Article, notwithstanding any provision of the underlying zoning to the contrary and without the requirement of further zoning relief.

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SECTION 73-12. **Update, Renewal, and Amendment of Institutional Master Plans.**

1. Annual Update. An approved Institutional Master Plan shall be updated annually, on or before the anniversary of the approval date of the Institutional Master Plan.

    To update its Institutional Master Plan, an Institution shall file with the Boston Redevelopment Authority a description of all projects that: (a) have been completed since the most recent annual update or Institutional Master Plan approval or renewal date, (b) are ongoing, including a description of the status and estimated timetables for completion of such projects, or (c) are scheduled to begin in the upcoming twelve (12) months, including estimated timetables for the commencement, progress, and completion of such projects. Such descriptions shall include any other information necessary to clarify the information required by items (a), (b), or (c) of this Section 73-12.1.

    The annual update of an Institutional Master Plan shall not constitute an amendment or renewal of such Institutional Master Plan, and the description of a project in such annual update shall not serve to add any such project to any applicable Institutional Master Plan without an amendment of such Institutional Master Plan pursuant to Section 73-12.3.

    Failure to update an Institutional Master Plan shall not affect the status under the Institutional Master Plan of then existing uses or structures, or of building, use, or occupancy permits already issued.

2. Time for Renewal or Amendment. An approved Institutional Master Plan may be renewed or amended at any time.

    If an Institution fails to file an IMPNF seeking renewal of an Institutional Master Plan on or before the eighth (8th) anniversary of the date of the later of (a) the Zoning Commission's approval of the original Institutional Master Plan, or (b) the most recent renewal thereof by the Zoning Commission (or by the Boston Redevelopment Authority, if no Zoning Commission review was required), or if, having made such filing, the Institution thereafter fails diligently to make the necessary filings and otherwise fulfill the requirements for renewal set forth in this Section 73-12, as determined by the Director of the Boston Redevelopment Authority, then the Director shall not issue any certificate of consistency, as described in Section 73-11, with respect to a Proposed Institutional Project of such Institution until such failure is remedied. Failure to file an IMPNF seeking renewal of an Institutional Master Plan prior to the expiration of such eight (8)- year period shall not affect the status under the Institutional Master

Plan of then existing uses or structures or of building, use, or occupancy permits already issued as of such expiration.

Except as otherwise specified in this Section 73-12, the new approval date for the Institutional Master Plan shall be the date of the Zoning Commission's approval of such renewal or amendment.

3. Procedure for Renewal or Amendment. The procedure for renewing or amending an Institutional Master Plan shall be identical to that for the initial approval of an Institutional Master Plan, except as set forth in subsections (a) through (c) of this Section 73-12.3.

An Institution may make a combined renewal and amendment submission to the Boston Redevelopment Authority, in which event the scope of such submission shall include the entire area described in the Institutional Master Plan Area, and the provisions of subsection (c) of Section 73-12.3 (Limited Scope of Review for Certain Master Plan Amendments) shall not apply.

(a) Review of Unchanged Plans. If, upon review of the IMPNF submitted in connection with the renewal or amendment of an Institutional Master Plan, the Boston Redevelopment Authority determines that no new Proposed Institutional Projects are planned, that no changes to the Institutional Master Plan are proposed that would constitute a change in the use, dimensional, parking, or loading elements of the Institutional Master Plan (other than de minimus dimensional changes), and that no significantly greater impacts would result from continued implementation of the Institutional Master Plan than were originally projected, then the Boston Redevelopment Authority shall waive further review of the renewal or amendment application and approve the IMPNF and original Institutional Master Plan together as the renewed or amended Institutional Master Plan.

A renewal or amendment pursuant to this subsection (a) that does not add additional land to the Institutional Master Plan shall not require further approval by the Zoning Commission, and the date of the Boston Redevelopment Authority's approval of such renewal or amendment shall constitute the new approval date for such Institutional Master Plan.

(b) Expedited Review of Amendment Adding Certain Small Projects. The Boston Redevelopment Authority, at the request of the Institution, shall waive the requirements of an IMPNF and Scoping Determination for approval of an amendment to an Institutional Master Plan, where the only change in the Institutional Master Plan provided for in the

proposed amendment is the inclusion of one or more additional Proposed Projects that are not subject to the Development Review requirements of Article 31, pursuant to Section 73-13, and that satisfy all the requirements of subsection (1) or (2) below, as applicable:

(1) the Proposed Project is exempt from the Institutional Master Plan requirements of Section 73-7, and the Institution elects to make such Proposed Project subject to the provisions of its Institutional Master Plan pursuant to Section 73-7; or

(2) the Proposed Project is not exempt from the Institutional Master Plan requirements of Section 73-7, and the Proposed Project meets all of the following requirements:

(i) the Proposed Project is located within an Institutional District or Subdistrict or, if the Proposed Project is for an Institutional Use (a "Proposed Institutional Project") and is located outside an Institutional District or Subdistrict, the use category, other than an Institutional Use, that most closely describes such Proposed Institutional Project is identified on the table of uses for that Institutional District or Subdistrict as an allowed use; and

(ii) if the Proposed Project is a Proposed Institutional Project and is located outside an Institutional District or Subdistrict, its dimensions and parking and loading spaces meet all the requirements applicable to the use category, other than Institutional Use, that most clearly describes the Proposed Institutional Project; and

(iii) for an Institutional Use, such Proposed Institutional Project is not for one or more of the High Impact Subuses identified in the definition of such use in Article 2A or for ambulatory clinical care facilities.

Notwithstanding any provisions to the contrary in Section 73-9.4, the Boston Redevelopment Authority shall issue its written Adequacy Determination under Section 73-9.4 concerning a proposed amendment to an Institutional Master Plan under this Section 73-12.3(b) within sixty (60) days after the submission of the proposed amendment to the Boston Redevelopment Authority, and public comments concerning such proposed amendment, including the comments of public agencies, shall be transmitted in writing to the Boston Redevelopment Authority within thirty (30) days after the

Boston Redevelopment Authority has published notice of such submission as required by Section 73-9.3.

Nothing in this subsection (b) shall affect the requirements set forth in Section 73-9.7 for full community participation in the Boston Redevelopment Authority's review of an amendment to an Institutional Master Plan, including the provisions for conducting a public hearing.

An amendment pursuant to this subsection (b) that does not add additional land to the Institutional Master Plan shall not require further approval by the Zoning Commission, and the date of the Boston Redevelopment Authority's approval of such amendment shall constitute the new approval date for such Institutional Master Plan.

(c) Limited Scope of Review for Certain Master Plan Amendments. If a proposed amendment is limited to the addition to the Institutional Master Plan of one or more Proposed Institutional Projects and does not involve renewal of the Institutional Master Plan, review by the Boston Redevelopment Authority shall be limited to such Proposed Institutional Project(s), taking into consideration the cumulative impacts of such Proposed Institutional Project(s) together with existing uses and other Proposed Projects described in an Institutional Master Plan.

Nothing in this subsection (c) shall affect the requirements set forth in Section 73-9.7 for full community participation in the Boston Redevelopment Authority's review of an amendment to an Institutional Master Plan, including the provisions for conducting a public hearing.

SECTION 73-13. **Applicability of Article 31 Development Review.**

1. Large Projects. Notwithstanding any provision of Section 31-4 to the contrary, the provisions of Article 31 (Development Review Requirements), other than Section 31-3, shall be applicable, except where otherwise specified in this Article, to any Proposed Project to: (a) erect a Building or Structure having a gross floor area of fifty thousand (50,000) or more square feet; or (b) enlarge a Building or Structure so as to increase its gross floor area by fifty thousand (50,000) or more square feet; or (c) establish or change the uses of a gross floor area of one hundred thousand (100,000) or more square feet; or (d) establish or change to conditional or forbidden uses the uses of a gross floor area of fifty thousand (50,000) or more square feet, or, in the case of a Proposed Institutional Project, to establish or change to a High Impact Subuse or ambulatory clinical care facility the subuses of a gross floor area of fifty thousand (50,000) or more square feet.

2. Certain Institutional Projects for New Construction. If a Proposed Institutional Project not otherwise subject to the provisions of Article 31, pursuant to Section 73-13.1: involves the erection or extension of a Building or Structure that results in the addition of a gross floor area of twenty thousand (20,000) or more square feet devoted to out-patient or in-patient care, such Proposed Institutional Project shall comply with the Transportation Access Plan requirements of Section 31-6.

The Commissioner of Inspectional Services shall not issue a building permit for any Proposed Project subject to the provisions of this Section 73-13 unless the Director of the Boston Redevelopment Authority has issued a certification of compliance with the applicable provisions of Article 31. Proposed Projects may proceed through the provisions of Article 31 separately or in joint filings, provided the Boston Redevelopment Authority has received adequate information on all such Proposed Projects.

SECTION 73-14. **Design Review.**

1. Applicability of Design Review. The provisions of this Section 73-14 shall apply only to those Proposed Projects specified in this Section 73-14 that are not subject to Article 31 development review pursuant to Section 73-13 or by election.

   The following Proposed Projects are subject to design review by the Boston Redevelopment Authority:

(a) Projects Visible from a Public Street or Public Park. Any Proposed Project for the erection or extension of one or more Buildings or Structures, if such Proposed Project is visible from a public street or public park; and

(b) Projects Adding 20,000 Square Feet of Floor Area. Any Proposed Project for the erection or extension of one or more Buildings that results in the addition of an aggregate gross floor area of twenty thousand (20,000) or more square feet.

The provisions of this Section 73-14 shall not apply to any Proposed Project that is subject to the jurisdiction of the Boston Landmarks Commission or other architectural board or commission having design review authority and established pursuant to a general or special law of the Commonwealth of Massachusetts.

The Commissioner of the Inspectional Services Department shall not issue a building or use permit for any Proposed Project that is subject to the provisions of this Section 73-14 unless the Director of the Boston Redevelopment Authority certifies that the design for such Proposed Project has been approved by the Boston Redevelopment Authority.

2. Procedure for Design Approval. Each application for a permit for a Proposed Project that is subject to design review by the Boston Redevelopment Authority pursuant to this Section 73-14 shall include a Design Review Application, containing the information required by Section 73-14.3, and shall be filed in duplicate with the Inspectional Services Department, which shall retain one copy for its files and transmit the other copy to the Boston Redevelopment Authority. The Boston Redevelopment Authority may find that the Proposed Project is consistent with the applicable design guidelines, as specified in Section 73-14.4, or is not consistent with those guidelines; provided that if no such findings are transmitted to the Inspectional Services Department within thirty (30) days of the receipt by the Boston Redevelopment Authority of the completed Design Review Application for the Proposed Project, the Proposed Project shall be deemed to be consistent with the applicable design guidelines without need for further action. Any Applicant aggrieved by the denial of any permit by the Inspectional Services Department pursuant to this Section 73-14 may appeal to the Board of Appeal within forty-five (45) days after such denial of a permit, in accordance with the provisions of Article 6.

3. Content of Design Review Application. A Design Review Application shall consist of such plans, drawings, and specifications as are necessary for the Boston Redevelopment Authority to determine that the Proposed Project is consistent with the applicable design guidelines. Such materials shall set

forth, for the existing conditions and for the Proposed Project: vehicular access and egress to and from the site; location and dimensions of all buildings, structures, and parking and loading areas; relationships of primary buildings to secondary buildings; landscaping and screening; roof shapes, cornice lines, and roof structures; facade articulation, fenestration, and other architectural features; and proposed sign locations.

4. Design Guidelines. The Boston Redevelopment Authority shall review each Proposed Project that is subject to design review under this Section 73-14 for consistency with any design guidelines adopted by the Zoning Commission or the Boston Redevelopment Authority for the area in which the Proposed Project is located.

MISCELLANEOUS PROVISIONS

SECTION 73-15. **Off-Street Parking and Loading**. Within the Dana-Farber Cancer Institute Institutional District, no off-street parking or loading facilities are required. For any Proposed Project that is subject to the Institutional Master Plan requirement of Section 73-7, zoning relief for the provision of off-street parking and loading facilities may be granted through the approval of such parking and loading facilities in an applicable Institutional Master Plan, notwithstanding any contrary provision of Section 3-1A.c. For any Proposed Project that also is subject to Article 31 development review, pursuant to Section 73-13 or by election, the approval of parking and loading requirements or specifications in an applicable Institutional Master Plan shall not preclude the establishment of restrictions on the number of parking spaces or the establishment of additional specifications for the design and location of parking and loading facilities through the Article 31 development review process.

All off-street parking or loading facilities provided for any Proposed Project that is not subject to Article 31 development review shall meet the following specifications:

1. Design.

   (a) Such facilities shall have adequate maneuvering areas and appropriate means of vehicular access to a street, and shall be so designed as not to constitute a nuisance or a hazard or unreasonable impediment to traffic; and all lighting shall be so arranged as to shine downward and away from streets and residences.

   (b) Such facilities, whether open or enclosed in a Structure, shall be so graded, surfaced, drained, and maintained as to prevent water and dust therefrom from going upon any Street or another Lot.

   (c) Off-street parking facilities shall not be used for automobile sales, dead storage, or repair work, dismantling, or servicing of any kind.

   (d) Each car space and loading bay shall be located entirely on the Lot.

2. Maintenance. Such facilities shall be maintained exclusively for the parking of motor vehicles, or for loading and unloading purposes, as the case may be, so long as a use requiring them exists. Such facilities shall be used in such a manner as at no time to constitute a nuisance or a hazard or unreasonable impediment to traffic.

SECTION 73-16. **Nonconformity as to Dimensional Requirements**. A Building or Structure existing on the effective date of this Article and not conforming to the applicable dimensional requirements specified in other provisions of this Article

may nevertheless be altered or enlarged, provided that such nonconformity is not increased and that any enlargement itself conforms to such dimensional requirements.

SECTION 73-17. **Regulations**. The Boston Redevelopment Authority may promulgate regulations to administer this Article.

SECTION 73-18. **Severability**. The provisions and requirements of this Article are severable, and if any such requirements or provisions shall be held invalid by any decision of any court of competent jurisdiction, such decision shall not impair or otherwise affect any other provision or requirement of this Article.

SECTION 73-19. **Definitions**. Words and phrases in this Article have the meanings set forth in Article 2A.

SECTION 73-20. **Tables**. The following tables are hereby made part of this Article:

Table A - Use Regulations
Table B - Dimensional Regulations

TABLE A

Dana-Farber Cancer Institute Institutional District
Use Regulations

Key: A = Allowed, C = Conditional, F = Forbidden
For definitions of use categories and certain specific uses, see Article 2A.
For requirements applicable to Institutional Uses, see Note 1.

<u>Banking and Postal Uses</u>	
Automatic teller machine	A
Bank	A
Drive-in bank	C
Post office	A
<u>Community Uses</u>	
Adult education center	A
Community center	A
Day care center	A
Day care center, elderly	A
Library	A
Place of worship; monastery; convent; parish house	A
<u>Cultural Uses</u>	
Art gallery	A
Art use	A
Auditorium	C
Cinema	C

TABLE A - Continued

Cultural Uses (cont'd)	
Concert hall	A
Museum	A
Public art, display space	A
Studios, arts	A
Studios, production	A
Theatre	A
Ticket sales	A
Dormitory and Fraternity Uses	
Dormitory not accessory to a use	C
Fraternity	C
Educational Uses	
College or university[1]	A
Elementary or secondary school[2]	A
Kindergarten	A
Professional school	A
Trade school	A
Entertainment and Recreational Uses	
Adult entertainment	F
Amusement game machines in commercial establishment	F
Amusement game machines in noncommercial establishment	C
Bar[3]	C
Bar with live entertainment[3]	F
Bowling alley	F

TABLE A - Continued

Entertainment and Recreational Uses (cont'd)	
Billiard parlor	F
Dance hall	F
Drive-in theatre	F
Fitness center or gymnasium	A
Private club not serving alcohol	C
Private club serving alcohol	C
Restaurant with live entertainment, not operating after 10:30 p.m.[3]	C
Restaurant with live entertainment, operating after 10:30 p.m.[3]	F
Funerary Uses	
Cemetery	F
Columbarium	F
Crematory	F
Funeral home	C
Mortuary chapel	A
Health Care Uses	
Clinic	A
Clinical laboratory	A
Custodial care facility	C
Group care residence, general	C
Hospital[1]	A
Nursing or convalescent home[1]	A

TABLE A - Continued

Hotel and Conference Center Uses	
Bed and breakfast	C
Conference center	C
Executive suites	C
Hotel	C
Motel	C
Industrial Uses	
Artists' mixed-use	F
Cleaning plant	F
General manufacturing use	F
Light manufacturing use	C
Printing plant	F
Restricted industrial use	F
Office Uses	
Agency or professional office	A
General office	A
Office of wholesale business	A
Open Space Uses	
Golf driving range	F
Grounds for sports, private	A
Open space	A
Open space recreational building	A
Outdoor place of recreation for profit	F
Stadium	F

TABLE A - Continued

<u>Public Service Uses</u>	
Automatic telephone exchange	A
Courthouse[2]	F
Fire station[2]	A
Penal institution[2]	F
Police station[2]	A
Pumping station[2]	C
Recycling facility (excluding facilities handling toxic waste)	F
Solid waste transfer station	F
Substation[2]	C
Telephone exchange	C
<u>Research and Development Uses</u>[4]	
Research laboratory	A
Product development; prototype manufacturing	A
<u>Residential Uses</u>	
Congregate living complex	C
Elderly housing	C
Group residence, limited	A
Lodging house	A
Mobile home	F
Mobile home park	F
Multifamily dwelling	A
One family detached dwelling	C
One family semi-attached dwelling	C
Orphanage	A

Residential Uses (cont'd)	
Rowhouse	A
Temporary dwelling structure	C
Three-family detached dwelling	A
Townhouse	A
Transitional housing or homeless shelter	A
Two-family detached dwelling	A
Two-family semi-attached dwelling	A
Restaurant Uses	
Drive-in restaurant	F
Restaurant	A
Take-out restaurant	
Small[5]	A
Large[6]	C
Retail Uses[7]	
Adult bookstore	F
Bakery	A
General retail business	A
Liquor store	A
Local retail business	A
Outdoor sale of garden supplies	F
Service Uses[7]	
Animal hospital	C
Barber or beauty shop	A
Caterer's establishment	A

TABLE A - Continued

Service Uses[7] (cont'd)	
Container redemption center	C
Dry-cleaning shop	A
Kennel	F
Laundry, retail service	A
Laundry, self-service	A
Photocopying establishment	A
Shoe repair	A
Tailor shop	A
Storage Uses, Major	
Enclosed storage of solid fuel or minerals	F
Outdoor storage of solid fuel or minerals	F
Outdoor storage of new materials	F
Outdoor storage of damaged or disabled vehicles	F
Outdoor storage of junk and scrap	F
Storage of flammable liquids and gases	
Small[8]	A
Large[8]	C
Storage or transfer of toxic waste	C
Warehousing	C
Wrecking yard	F
Trade Uses[7]	
Carpenters shop	A
Electrician's shop	A

Trade Uses[7] (cont'd)	
Machine shop	A
Photographer's studio	A
Plumber's shop	A
Radio/television repair	A
Upholsterer's shop	A
Welder's shop	A
Transportation Uses	
Airport	F
Bus terminal	C
Garage with dispatch	F
Helicopter landing facility	C
Motor freight terminal	F
Rail freight terminal	F
Railroad passenger station	F
Vehicular Uses	
Bus servicing or storage	F
Carwash[9]	F
Gasoline station[9]	F
Indoor sale and installation of automotive parts	F
Indoor sale of automobiles and trucks	F
Outdoor sale of new and used vehicles	F
Parking garage	C
Parking lot	C

TABLE A - Continued

<u>Vehicular Uses</u> (cont'd)

Rental agency for cars	F
Rental agency for trucks	F
Repair garage	F
Truck servicing or storage	F

<u>Wholesale Uses</u>

Wholesale business	F

<u>Accessory and Ancillary Uses</u>

In the Dana-Faber Cancer Institute Institutional District, an accessory use ordinarily incident to a lawful main use is allowed, subject to the provisions of Article 10, unless such use is (i) specifically forbidden as a main use for such subdistrict in this Table A and (ii) not designated "A" or "C" in the accessory use table below. In any event, an accessory use shall be subject to the same restrictions, conditions, limitations, provisos and safeguards as the use to which it is accessory.

Accessory amusement game machines (not more than four) in commercial or noncommercial establishment	C
Accessory art use	A
Accessory automatic teller machine	A
Accessory bus servicing or storage	A
Accessory cafeteria	A
Accessory cultural uses	A
Accessory dormitory	C
Accessory drive-through restaurant	F
Accessory drive-through retail	F
Accessory family day care home	A
Accessory home occupation	A

TABLE A - Continued

<u>Accessory and Ancillary Uses</u> (cont'd)

Accessory industrial use	C
Accessory keeping of laboratory animals[4]	A
Accessory keeping of animals, other than laboratory animals	F
Accessory machine shop	A
Accessory manufacture of products	C
Accessory offices	A
Accessory outdoor cafe	A
Accessory parking	C[10]
Accessory personnel quarters	A
Accessory printing	A
Accessory professional office in a dwelling	A
Accessory railroad storage yard	F
Accessory recycling	A
Accessory repair garage	A
Accessory retail	A
Accessory services for apartment and hotel residents	A
Accessory services incidental to educational uses other than college or university use	A
Accessory service uses	A
Accessory storage of flammable liquids and gases	
Small[8]	A
Large[8]	A
Accessory storage or transfer of toxic waste	A
Accessory swimming pool or tennis court[11]	A

TABLE A - Continued

Accessory and Ancillary Uses (cont'd)

Accessory trade uses	A
Accessory truck servicing or storage	A
Accessory wholesale business	A
Ancillary use[12]	C

---

1. Note regarding Institutional Uses. The Institutional Use categories "College or University Use," "Hospital Use," and "Nursing or Convalescent Home Use," are defined in Article 2A to include subuses (office, parking, etc.) that also appear as main uses in this Table A. If part of an Institutional Use, pursuant to the provisions of this Article and Article 2A, any such subuse shall be regulated as the pertinent Institutional Use and not as an accessory or ancillary use subject to Article 10 or as an independent use.

   See Sections 72-3, 72-5, 72-7, and 72-11 concerning the applicability of the use regulations of this Table A to Institutional Uses. All Institutional Uses, as defined in Article 2A, are subject to the Institutional Master Plan requirements of Sections 72-7 through 72-12, unless specifically exempted therefrom under the provisions of Section 72-7.

   Except for High Impact Subuses, and except for ambulatory clinical care facilities that are not otherwise exempt from the provisions of this Article 72 pursuant to Section 72-7, or that are exempt from such requirements pursuant to Section 72-7 but are electively described in an Institutional Master Plan, the substitution of one Institutional subuse for another Institutional subuse shall not be treated as a change of use, and no determination of consistency with an Institutional Master Plan pursuant to Section 72-11 shall be required for such substitution. (The "High Impact Subuses" of an Institutional Use are identified in the definition of such Institutional Use set forth in Article 2A.)

2. Provided that, where such use is located in an area where residential uses are permitted: (1) the requirements of St. 1956, c. 665, s.2, where applicable, are met; (2) the use is essential to service in the residential area in which it is located; and (3) in the case of a pumping station, sub-station, or automatic telephone exchange, no storage building or yard is maintained in connection with such use.

TABLE A - Continued

3. Provided that, where such use exists on the effective date of this Article and is designated "F," any expansion of seating or standing capacity of such use is forbidden, notwithstanding any contrary provision of Article 9.

4. Provided that such use shall comply with all the guidelines and standards promulgated by the National Institutes of Health concerning the care and use of laboratory animals.

5. Total gross floor area not more than 1,000 square feet per restaurant.

6. Total gross floor area exceeding 1,000 square feet per restaurant.

7. If a Retail, Service, or Trade Use is designated "A," it shall be conditional if merchandise is sold or displayed out-of-doors or if such establishment is open to the public after midnight or before 6:00 a.m. and such establishment has direct public access to a public way or sidewalk.

8. Small: storage of less than thirty thousand (30,000) gallons of flammable liquids or less than ten thousand (10,000) cubic feet of gases; Large: storage of thirty thousand (30,000) gallons or more of flammable liquids or ten thousand (10,000) cubic feet or more of gases.

9. Where such use is designated "A," or "C," provided that all washing, painting, lubricating, and making of repairs is carried on inside a building; that such establishment is sufficiently sound insulated to confine all noise to the lot; that all flashing, fumes, gases, smoke and vapor are effectively confined to the lot; and that there is no outdoor storage of damaged, disabled or unregistered motor vehicles for a period of more than one month; otherwise forbidden.

10. Except allowed if accessory to a residential use, dormitory or fraternity use, or hotel or conference center use (all as defined in Article 2A, and including any dwelling converted for more families in separate dwelling units).

11. Provided that such use is more than four (4) feet from every lot line, and in the case of a swimming pool, that it is protected by a fence at least six (6) feet in height with a gate locked from the outside, and that if the pool is within ten (10) feet of a lot line, the fence is concealing to a height of at least six (6) feet.

12. Provided that any such use shall be subject to the same restrictions, conditions, limitations, provisos and safeguards as the use to which it is ancillary.

Text Amendment Application No. 241

Text Amendment No. 208

Chairman

Vice Chairman

In Zoning Commission

Adopted March 29, 1994

Attest:

Secretary

Text Amendment Application No. 241

Text Amendment No. 208

Thomas M. Menino

Mayor, City of Boston

Date: 4/8/94

The foregoing amendment was presented to the Mayor on April 1, 1994, and was signed by him on April 8, 1994, whereupon it became effective on April 8, 1994, in accordance with the provisions of Section 3 of Chapter 665 of the Acts of 1956.

Attest: Sheila Keogh

Secretary ot the Zoning Commission

#/ コ

Map Amendment Application No. 365
Boston Redevelopment Authority
Boston Proper and Roxbury:
Dana-Farber Cancer Institute
Institutional District and
Dana-Farber Cancer Institute
Institutional Master Plan Area

MAP AMENDMENT NO. 306

EFFECTIVE
April 8, 1994*

THE COMMONWEALTH OF MASSACHUSETTS

CITY OF BOSTON

IN ZONING COMMISSION

The Zoning Commission of the City of Boston, acting under Chapter 665 of the Acts of 1956 as amended, after due report, notice, and hearing does hereby amend "Map 1 Boston Proper and Map 6 Roxbury," of the series of maps entitled "Zoning Districts City of Boston," dated August 15, 1962, as follows:

1. By changing from "H-3" (Apartment) district and "L-1" (Local Business) district to "Dana-Farber Cancer Institute Institutional District" the land in the Fenway area depicted on Appendix A hereto as "Dana-Farber Cancer Institute Institutional District" and bounded generally as follows:

   Northwesterly by the centerline of Brookline Avenue between the sidelines extended of the Medical Area Total Energy Plant (MATEP) and property now or formerly of Children's Hospital known as 454 Brookline Avenue;

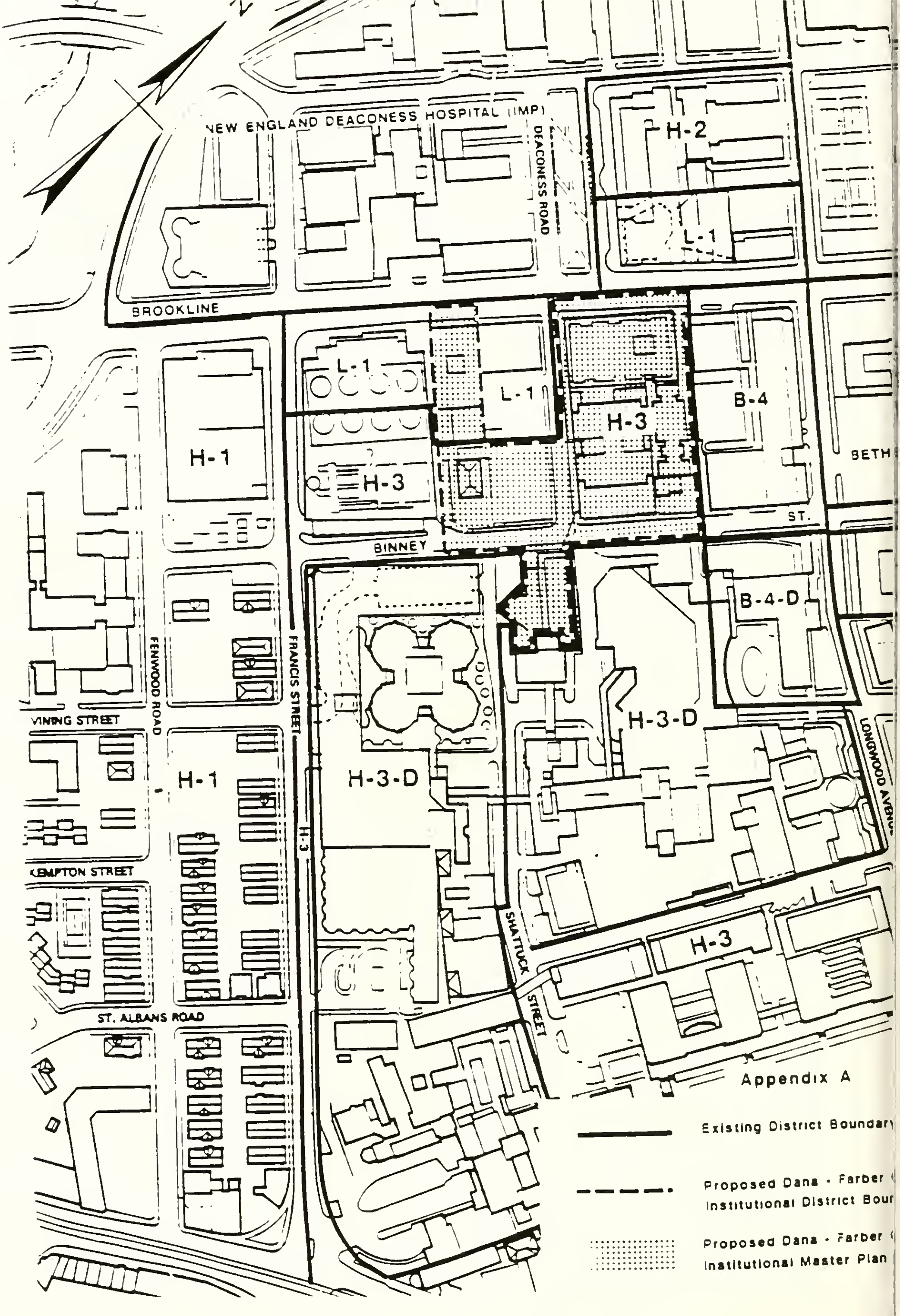
   Northeasterly and northwesterly by said property at 454 Brookline Avenue;

   Southwesterly by the centerline of Deaconess Road;

   Northwesterly by the centerline of Brookline Avenue;

   Northeasterly by the southeasterly line of the B-4 zoning district containing land now or formerly of Children's Hospital, which line extends from the centerline of Brookline Avenue to the southeast line of Binney Street;

   Northeasterly and southeasterly by two adjacent H-3-D zoning districts containing land now or formerly of Children's Hospital and Brigham and Women's Hospital in PDA No. 29 and PDA No. 10, respectively, which



NEW ENGLAND DEACONESS HOSPITAL (IMP)
DEACONESS ROAD
H-2
L-1
BROOKLINE
L-1
L-1
H-1
H-3
H-3
B-4
BETH
ST.
BINNEY
B-4-D
FENWOOD ROAD
FRANCIS STREET
H-3-D
H-3-D
LONGWOOD AVENU
VINING STREET
H-1
KEMPTON STREET
H-3
SHATTUCK STREET
ST. ALBANS ROAD
H-3
Appendix A
Existing District Boundar
Proposed Dana - Farber
Institutional District Bour
Proposed Dana - Farber
Institutional Master Plan

Map Amendment Application No. 365

Map Amendment No. 306

Thomas M. Menino

Mayor, City of Boston

Date: 4/8/94

The foregoing amendment was presented to the Mayor on April 1, 1994, and was signed by him on April 8, 1994, whereupon it became effective on April 8, 1994, in accordance with the provisions of Section 3 of Chapter 665 of the Acts of 1956.

Attest: Sheila Keogh

Secretary to the Zoning Commission

APPENDIX D
MASCO Letter

DANA-FARBER
CANCER INSTITUTE

M A S C O

MEDICAL ACADEMIC AND SCIENTIFIC COMMUNITY ORGANIZATION, INC.

May 12, 1994

Mr. John W. Pettit
Chief Administrative Officer
Dana-Farber Cancer Institute
44 Binney Street
Boston, MA 02115

RE: DEIR Certificate EOEA #9452/Dana-Farber Cancer Institute

Dear Mr. Pettit:

In response to your request for information relating to Dana-Farber Cancer Institute's final PIR/EIR, I offer the following background information.

Infrastructure Planning

MASCO recently completed a number of planning documents that address development, energy (chilled water and electricity in particular), and transit. Our LMA Transportation Study, updated in 1992, continues to be used as a framework for implementing access improvements within the LMA (see attached list). We have also cooperated with the City of Boston on the Scope of Work for their West Fenway/Longwood Transportation Management Strategies Study intended to complement the policy objectives contained in the District Plan. As you know, we have been working closely with the BRA to complete an LMA District Plan, a draft of which is under review by the community.

Recommendations from our 1992 update of the LMA Transportation Study and recently completed Long-Range Transit Study for the LMA are being implemented to address both locally generated traffic, as well as traffic which results from through trips (three of the major downtown travel corridors intersect the LMA). To this end, and of importance to EOEA, MASCO on behalf of its member institutions, has been active on a number of initiatives toward improving mass transit. Certainly the completion of a transit plan for the LMA is a very important accomplishment. A long-term recommendation of this study, which confirms what MASCO has recognized as the most important transit improvement to the LMA, is implementation of the full circumferential line. As you know, MASCO on behalf of its members was instrumental in forming a group of 35 large employers in the circumferential corridor, called Circumferential Transit Employers Coalition (CTEC), to educate private businesses and public agencies on the need for accelerated transit planning to serve the economic development needs of the corridor's institutions and businesses. We have also chaired a Working Group of the Greater Boston Chamber of Commerce's Transportation Committee focusing on this issue, and provided testimony during the recent public hearings on the Transportation Bond Bill supporting an amendment to include an additional $4 million to complete studies necessary to position the circumferential improvements for Federal funding. As we have offered in the past, MASCO would be happy to brief Executive Office of Environmental Affairs (EOEA) on the need for

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circumferential service improvements and the need for interagency communication within the Administration on this important infrastructure improvement.

The Transit Study also recommends for the short- to mid-term, privately funded initiatives such as fixed route shuttles to connect the LMA to employee population centers and/or commuter rail/rapid transit. Funding strategies are being considered for a pilot project implementation in the Fall of 1994. As an example, a Back Bay Shuttle would provide a more accessible connection between the LMA and the Commuter Rail Lines (Framingham, Attleboro, Stoughton, Franklin, and Needham) serving Back Bay Station.

A number of system management improvements have recently been completed or are in the planning stages that will benefit the area including: major signal modifications at Longwood Avenue and The Riverway, Longwood Avenue and Chapel Street; and, signal modifications at Longwood Avenue and Huntington Avenue. In addition, a lane will be added to the Longwood Avenue westbound approach to Brookline Avenue as part of Beth Israel's Clinical Research Center Project. This improvement, along with the already completed meter removal along Longwood Avenue and Brookline Avenue, will result in a Level of Service (LOS) of C during both AM and PM peak hours at Longwood and Brookline Avenues, which will not only improve vehicle flow but also the ability of MBTA buses to maneuver through this major intersection.

Demand Management

The Dana-Farber was the first institution to offer a vanpool subsidy to its employees. This program, which provides a 25% monthly subsidy on the cost of participating in a vanpool, has also inspired other LMA institutions to offer a similar vanpool subsidy. The creation of institution-sponsored vanpool subsidies are essential to a successful vanpool formation program that MASCO, with its members, have been aggressively pursuing. In addition to this first-of-a-kind subsidy program, the Dana-Farber also provides a 25% T-Pass subsidy and was one of the first institutions to commit to locating employees in remote parking facilities.

CommuteWorks, the LMA's Transportation Management Association (TMA) which Dana-Farber helps to fund and of which it is an active member, provides a number of services including: computerized rideshare matching; full-time transportation coordinator; a full service transportation store (The Ticket Office) located at the Longwood Galleria where employees and patients can purchase MBTA tokens and visitors passes as well as receive commuting information assistance; free vanpool parking; auxiliary parking for those employees who rideshare but need to use their cars up to five times per month; annual transportation events such as BIKE LMA '94 and our FREE VANPOOL RIDE offer this year; other marketing efforts to promote commuting alternatives; membership in the Boston Transportation Management Council (BTMC); and new vanpool initiatives. An example of a new vanpool initiative is our successful application to the State's TMA Assistance Program, for funds to support aggressive formation of new vanpools. Within the past four months since receiving State assistance, MASCO has established two new vanpools with the expectation that these and two more will be created and fully subscribed in eight months. The area's ability to maintain a stable transit share in the past

ten years compared to the city-wide transit share decline, is an example of our efforts to reduce the number of single passenger vehicles coming to the LMA.

I would be happy to provide you with additional information on these and other infrastructure planning efforts we are conducting for the LMA.

Sincerely,

Sarah Hamilton

Sarah Hamilton
Director, Area Planning and Development

cc: Mitchell Fischman, HMM Associates
Trudy Coxe, Secretary of Executive Office of Environmental Affairs, c/o Bill Gage

M A S C O

MEDICAL ACADEMIC AND SCIENTIFIC COMMUNITY ORGANIZATION, INC.

Update to Attached Table 7 from the 1992 LMA Transportation Study Update

Number	Description	Status
A8	Modify Sears Rotary	New retail project proposed for site, waiting for proposed mitigation measures.
B9	Upgrade Longwood Avenue signals at The Riverway and Chapel Street	Completed.
C2	Northbound Left restriction at Huntington and Longwood Avenues	Concept plan to be submitted to BTD.
D4	Ridesharing Program	MASCO, through CARAVAN For Commuters has updated its program to the latest version of RideSource and has over 800 subscribers to the service.
D7	Improved MBTA service to Ruggles Station and Roxbury-Dorchester	The MBTA will be implementing limited stop service along this corridor in the Fall, 1994. The LMA Long-Range Transit Study also recommends the extension of MBTA Route 23 to the LMA. MASCO will be working with the MBTA to complete this extension.
E1	Parking Management	MASCO has completed the long-range areawide parking study and is using it as a guide to parking management. The most recent improvements include: a Park&Ride service from Newton; the start of consolidating shuttle bus services; and, establishment of a Transportation Strategy Committee which develops areawide policy for the coordination of transportation and parking.

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MEMBER INSTITUTIONS • Beth Israel Hospital • Brigham and Women's Hospital • Children's Hospital • Dana-Farber Cancer Institute
Deaconess Hospital • Emmanuel College • Harvard University (Medical School, School of Dental Medicine, and School of Public Health)
Joslin Diabetes Center • Massachusetts College of Pharmacy and Allied Health Sciences • Simmons College • Temple Israel • Wheelock College • Winsor School

Table 7 STATUS OF 1987 LMA TRANSPORTATION STUDY RECOMMENDATIONS

Number	Description	Status
Roadway Construction Strategies		
A1	Modify Intersection of Fenway and Avenue Louis Pasteur	Will be beneficial to Ave. Louis Pasteur developments including reuse of English High School, Blackfan St. extension
A2	Connect Parking Facilities to Avenue Louis Pasteur	Part of long-range planning for LMA.
A3	Widen Longwood Ave. Between Binney St. and Brookline Ave.	Expected to occur as part of the Clinical Center development at Beth Israel Hospital
A8	Modify the Sears Rotary: Close its Eastern Loop and Signalize The Riverway Merge	Olmsted Plaza mitigation funding for improvements is now uncertain. These strategies should still be actively pursued, however.
Other Roadway Improvements		
B1-B8	Reallocate Available Roadway Width and Green Signal Time	Meters have been removed on Longwood and Brookline Avenues. Future meter removals should be considered. Current signal timing and phasing should be re-evaluated by MASCO with the BTD and MDC.
B9	Upgrade the Longwood Avenue/Riverway Signal; Extend to Chapel Street	Proposed to BTD as part of MASCO FY92 traffic improvement program
Circulation Changes		
C1	Riverway/Brookline Avenue One-Way Pair	Can continue to be deferred for longer-term consideration due to reduced volumes in LMA.
C2	Northbound Left-Turn Restriction at Huntington/Longwood Aves.	Proposed to BTD as part of MASCO FY92 traffic improvement program
C8	Make Pilgrim Road Two-Way From Joslin Pl. to Deaconess Garage	Will be included in New England Deaconess Hospital plans.
Traffic Reduction Strategies		
D1	Raise Parking Fees for Employees	See E1 below
D2	Provide and Market Transit Subsidies for Employees	Most institutions sell and subsidize T passes. CommuteWorks markets availability of transit subsidies to employees. Additional strategies are being discussed.
D4	Ridesharing Program	CommuteWorks provides the RideSource computerized matching service. Over 250 commuters participated in the first year. This should be continued.
D5	"Alternatives to Driving Alone to the LMA" Campaign	CommuteWorks holds transportation days twice per year. These are promotional events to stimulate interest in transportation options.
D6	Improve MBTA Service on the Riverside and Arborway Lines	MBTA has increased number of cars per train and Arborway Line has been extended to Heath Street

Table 7 STATUS OF 1987 LMA TRANSPORTATION STUDY RECOMMENDATIONS (Cont'd.)

Number	Description	Status
Traffic Reduction Strategies (Continued)		
D7	Improve MBTA Service to Ruggles Station and Roxbury-Dorchester (Extend MBTA Bus Route 19 into the LMA)	MBTA has extended Route 8 to Kenmore via LMA improving service to Ruggles. Service to Roxbury has not been improved.
D11	Coordinate a Voluntary Staggered Work Hours Program	Most institutions have an informal program. CommuteWorks is working to expand staggered work hours wherever possible.
Management Strategies		
E1	Parking Management	MASCO is undertaking a long-range areawide parking study to help determine overall parking conditions and future needs.
E2	Improve Enforcement of Traffic and Parking Regulations	This requires a consistent level of effort by the BTD.
E3	Construction Management	Controlled by BTD's Construction Management Agreements for each development project and coordinated closely by MASCO and with city support.
E4	Restrain Street Closures	Policy has been adopted by MASCO member and has City support
E5	Limit On-Street Loading	To be studied by MASCO staff in the future
E6	Detail Traffic Control Officers at LMA Intersections	This action should be placed on hold for future consideration.
E9	Assessments for LMA Transportation Improvements	Each institution has remained responsible for making its own roadway improvements necessitated by development projects.
Pedestrian Access Improvements		
F1	Install Stop Sign at Avenue Louis Pasteur and Longwood Avenue	Completed
F2	Provide Security to MBTA Users	Some institutions (Children's, Harvard, Betl Israel) are providing shuttles or taxi vouchers to take employees to MBTA statior
F3	Improve Streetscape Amenities	Being addressed through MASCO open spac program and by members through development projects.
F4	Improve Connection to Longwood Station	Short Street signal proposal is on hold as a result of concerns raised by abutters
Site Design Considerations		
G1	Keep Garage Queues and Drop-Off Driveway Queues Off Streets	Incorporated in all recent projects.

APPENDIX E
Traffic / Transportation Data

DANA-FARBER
CANCER INSTITUTE

Revised Level of Service Calculations

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
1- BROOKLINE AVE/RIVERWAY - BUILD
1998 BUILD AM
date:05-09-1994 time:13:20:07
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=1AM98B GEOMETRICS=1AM98B SIGNAL=1AM98B
LOCATED IN CBD:Y

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	56	533	56	0	2	0	0.0	11.0	0.0	60
WB	15	852	873	0	1	1	0.0	11.0	11.0	60
NB	154	567	5	0	2	0	0.0	10.0	0.0	60
SB	195	418	12	0	2	1	0.0	10.0	10.0	60

TRAFFIC & ROADWAY CONDITIONS

			ADJ	PARK			PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	1.0%	N	0	0	.850	10	Y	22.0	3
WB	0.0%	1.0%	N	0	0	.930	10	Y	22.0	3
NB	0.0%	2.0%	Y	0	0	.890	10	Y	22.0	3
SB	0.0%	2.0%	N	0	1	.980	10	Y	22.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*										58.0	5	A
2				*				*				*				*	0.0	0	A
3							*						*	*	*		9.0	0	A
4									*	*	*		*	*	*		23.0	5	A

CYCLE= 100.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	56	533	56	.850	66	627	66
WB	15	852	873	.930	16	916	939
NB	154	567	5	.890	173	637	6
SB	195	418	12	.980	199	427	12

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH-RT	759	2	1.05	797	0.09	0.09
WB	LT-TH	932	1	1.00	932	0.02	0.00
WB	RT	939	1	1.00	939	0.00	1.00
NB	LT-TH-RT	816	2	1.05	857	0.21	0.01
SB	LT-TH	626	2	1.05	657	0.32	0.00
SB	RT	12	1	1.00	12	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	16	916	939	100	100	0	0	1	1	916
WESTBOUND	66	627	66	100	100	100	0	2	0	759
NORTHBOUND	199	427	12	72	72	0	0	2	1	450
SOUTHBOUND	173	637	6	100	100	100	0	2	0	816

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH-RT	1800	2	0.967	0.995	1.000	1.000	1.000	0.900	0.987	0.570	1754
WB	LT-TH	1800	1	0.967	0.995	1.000	1.000	1.000	0.900	1.000	0.813	1267
WB	RT	1800	1	0.967	0.995	1.000	1.000	1.000	0.900	0.850	1.000	1324

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IB  LT-TH-RT  1800  2 0.933 0.990 1.000 1.000 1.000 0.900 0.999 0.619 1853
B   LT-TH     1800  2 0.933 0.990 1.000 1.000 1.000 0.900 1.000 0.757 2266
B   RT        1800  1 0.933 0.990 1.000 1.000 0.996 0.900 0.850 1.000 1267

UPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
NPUT VARIABLES
IR  C    G   N    Va    Vm   Vlt   Plt No    Vo Plto
B 100   58   2   759   759    66 0.09  1   916 0.02
B 100   58   1   932 1399    16 0.02  2   759 0.09
B 100   23   2   816   816   173 0.21  2   450 0.32
ALCULATIONS
IR Sop     Yo      Gu     Fs     Pl      Gq     Pt      Gf          El     Fm    Flt
B 1745 0.525 11.602 0.302 0.716 46.398 0.284  0.795       3.720 0.141 0.570
B    23 1.000  0.000 0.401 0.017 58.000 0.983 45.119       2.807 0.813 0.813
B 2166 0.208  2.833 0.594 1.000 20.167 0.000  0.000       1.894 0.239 0.619

APACITY ANALYSIS WORKSHEET
IR LN GROUP     v     s  v/s  g/C    c  v/c  CRITICAL
B  LT-TH-RT  797 1754 0.45 0.58 1018 0.78
B  LT-TH     932 1267 0.74 0.58  735 1.27     *
B  RT        939 1324 0.71 0.67  887 1.06
B  LT-TH-RT  857 1853 0.46 0.23  426 2.01     *
B  LT-TH     657 2266 0.29 0.32  725 0.9
B  RT         12 1267 0.01 0.32  405 0.03

YCLE=100.0  LOST=10.0  SUM V/S CRIT= 1.20 TOTAL V/C= 1.33

EVEL OF SERVICE WORKSHEET
IR LN GROUP  v/c  g/C   C      d1     c      d2    PF   Delay LOS Avg Q  95% Q
B  LT-TH-RT 0.78 0.58 100.0  12.28 1018     2.83 0.85   12.85  B   8.9
B  LT-TH    1.27 0.58 100.0  25.38  735   162.90 0.85  160.04  F  46.9
B  RT       1.06 0.67 100.0  14.21  887    40.18 0.85   46.23  E  16.4
B  LT-TH-RT 2.01 0.23 100.0  41.90  426 1437.16 0.85 1257.20  F 293.6
B  LT-TH    0.91 0.32 100.0  24.74  725    10.73 0.85   30.15  D  11.8
B  RT       0.03 0.32 100.0  17.74  405     0.00 0.85   15.08  C   0.2

IR Delay LOS
B  12.85  B
B 102.94  F
B %1257.20  F
B  29.87  D
NTERSECTION DELAY =309.93 INTERSECTION LOS=F

HE CYCLE LENGTH WITHIN THE BOUNDS OF  100  TO  100 SECONDS
HICH MINIMIZES CRITICAL MOVEMENT DELAY IS 100.0 SECONDS

HE V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
or chosen cycle length 100.0
uggested timing phase 1 is  55.3 secs green,   5.0 secs yellow + red clear
uggested timing phase 2 is   0.0 secs green,   0.0 secs yellow + red clear
uggested timing phase 3 is   0.0 secs green,   0.0 secs yellow + red clear
uggested timing phase 4 is  34.7 secs green,   5.0 secs yellow + red clear
```

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
BROOKLINE AVENUE/RIVERWAY
1 PM 98BUILD W/O PED PHASE
date:05-09-1994 time:13:24:16
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=1PM98B GEOMETRICS=1PM98B SIGNAL=1PM98B
LOCATED IN CBD:Y

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	5	966	29	0	2	0	0.0	11.0	0.0	60
WB	15	706	294	0	1	1	0.0	11.0	11.0	60
NB	126	461	6	0	2	0	0.0	10.0	0.0	60
SB	658	720	22	0	2	1	0.0	10.0	10.0	60

TRAFFIC & ROADWAY CONDITIONS

			ADJ	PARK			PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	0.0%	N	0	0	.960	10	Y	22.0	3
WB	0.0%	0.0%	N	0	0	.930	10	Y	22.0	3
NB	0.0%	2.0%	Y	0	0	.930	10	Y	22.0	3
SB	0.0%	1.0%	N	0	1	.890	10	Y	22.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*										53.0	5	A
2				*				*				*				*	0.0	0	A
3							*						*	*	*		26.0	0	A
4									*	*	*		*	*	*		26.0	5	A

CYCLE= 115.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	5	966	29	.960	5	1006	30
WB	15	706	294	.930	16	759	316
NB	126	461	6	.930	135	496	6
SB	658	720	22	.890	739	809	25

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH-RT	1042	2	1.05	1094	0.01	0.03
WB	LT-TH	775	1	1.00	775	0.02	0.00
WB	RT	316	1	1.00	316	0.00	1.00
NB	LT-TH-RT	638	2	1.05	670	0.21	0.01
SB	LT-TH	1548	2	1.05	1626	0.48	0.00
SB	RT	25	1	1.00	25	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	16	759	316	100	100	0	0	1	1	759
WESTBOUND	5	1006	30	100	100	100	0	2	0	1042
NORTHBOUND	739	809	25	50	50	0	0	2	1	774
SOUTHBOUND	135	496	6	100	100	100	0	2	0	638

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH-RT	1800	2	0.967	1.000	1.000	1.000	1.000	0.900	0.996	0.764	2382
WB	LT-TH	1800	1	0.967	1.000	1.000	1.000	1.000	0.900	1.000	0.933	1461
WB	RT	1800	1	0.967	1.000	1.000	1.000	1.000	0.900	0.850	1.000	1331

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NB  LT-TH-RT  1800  2 0.933 0.990 1.000 1.000 1.000 0.900 0.998 0.577 1725
SB  LT-TH     1800  2 0.933 0.995 1.000 1.000 1.000 0.900 1.000 0.757 2278
SB  RT        1800  1 0.933 0.995 1.000 1.000 0.996 0.900 0.850 1.000 1273

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES
DIR  C    G  N   Va   Vm   Vlt  Plt No   Vo Plto
EB 115   53  2 1042 1042     5 0.01  1  759 0.02
WB 115   53  1  775 1075    16 0.02  2 1042 0.01
NB 115   26  2  638  638   135 0.21  2  774 0.48
CALCULATIONS
DIR Sop    Yo     Gu    Fs    Pl     Gq    Pt     Gf        El    Fm   Flt
EB 1661 0.457  0.810 0.401 0.060 52.190 0.940 25.119    2.809 0.528 0.764
WB 3520 0.296 26.941 0.224 0.021 26.059 0.979 22.556    5.023 0.933 0.933
NB 2182 0.355  0.000 0.391 1.000 26.000 0.000  0.000    2.876 0.154 0.577

CAPACITY ANALYSIS WORKSHEET
DIR LN GROUP    v    s  v/s  g/C    c  v/c  CRITICAL
EB  LT-TH-RT 1094 2382 0.46 0.46 1098 1.00
WB  LT-TH     775 1461 0.53 0.46  673 1.15     *
WB  RT        316 1331 0.24 0.69  914 0.35
NB  LT-TH-RT  670 1725 0.39 0.23  390 1.72
SB  LT-TH    1626 2278 0.71 0.45 1030 1.58     *
SB  RT         25 1273 0.02 0.45  576 0.04

CYCLE=115.0  LOST=10.0  SUM V/S CRIT= 1.24 TOTAL V/C= 1.36

LEVEL OF SERVICE WORKSHEET
DIR LN GROUP  v/c  g/C   C     d1    c      d2   PF   Delay LOS Avg Q  95% Q
EB  LT-TH-RT 1.00 0.46 115.0  23.49 1098   20.07 0.85   37.02  D  19.7
WB  LT-TH    1.15 0.46 115.0  27.06  673   86.00 0.85   96.10  F  27.4
WB  RT       0.35 0.69 115.0   5.62  914    0.10 0.85    4.85  A   3.2
NB  LT-TH-RT 1.72 0.23 115.0  42.78  390  755.59 0.85  678.62  F 128.1
SB  LT-TH    1.58 0.45 115.0  45.81 1030  507.49 0.85  470.30  F 215.8
SB  RT       0.04 0.45 115.0  13.37  576    0.00 0.85   11.37  B   0.4

DIR Delay LOS
EB  37.02  D
WB  69.67  F
NB 678.62  F
SB 463.43  F
INTERSECTION DELAY =296.49 INTERSECTION LOS=F

THE CYCLE LENGTH WITHIN THE BOUNDS OF  115  TO  115 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 115.0 SECONDS

THE V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
for chosen cycle length 115.0
suggested timing phase 1 is  44.8 secs green,   5.0 secs yellow + red clear
suggested timing phase 2 is   0.0 secs green,   0.0 secs yellow + red clear
suggested timing phase 3 is  30.1 secs green,   0.0 secs yellow + red clear
suggested timing phase 4 is  30.1 secs green,   5.0 secs yellow + red clear
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CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
3- BROOKLINE AVE/FRANCIS ST
3-BUILD 98 AM
date:05-09-1994              time:13:27:02
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=3AM98B     GEOMETRICS=3AM98B     SIGNAL=3AM98B
LOCATED IN CBD:Y
VOLUME & GEOMETRICS
       VOLUMES        # OF LANES      LANE WIDTH      CROSS
DIR  LT    TH    RT    LT TH RT      LT    TH    RT     WALK
EB   20    67    16     1  1  0    10.0 10.0   0.0     40
WB  138    77   139     1  1  0    12.0 11.0   0.0     40
NB   35  1094   274     1  1  1    11.0 12.0  10.0     60
SB  217   476    58     1  1  1    12.0 10.0   8.0     60

TRAFFIC & ROADWAY CONDITIONS
                  ADJ PARK                PEDESTRIANS        ARR
DIR GRADE %HV    Y/N MOVES BUSES  PHF  CROSS BUT MIN TIME TYPE
EB  0.0%  0.0%    N      0     0  .800   35    Y    17.0     3
WB  0.0%  1.0%    N      0     0  .870   66    Y    17.0     3
NB  0.0%  2.0%    Y      0     1  .890   42    Y    22.0     3
SB  0.0%  1.0%    Y      0     1  .970   55    Y    22.0     3

PHASINGS
   EASTBOUND   WESTBOUND   NORTHBOUND  SOUTHBOUND GREEN  Y+R PRE/ACT
   l  t  r  p  l  t  r  p  l  t  r  p  l  t  r  p
 1                         *  *  *     *  *  *     79.0   5    A
 2 *  *  *     *  *  *                             11.0   5    A
 3          *           *           *           *   0.0   0    A

CYCLE= 100.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)
DIR   LTV  THV  RTV   PHF  LTFR THFR RTFR
EB     20   67   16  .800    25   84   20
WB    138   77  139  .870   159   89  160
NB     35 1094  274  .890    39 1229  308
SB    217  476   58  .970   224  491   60

PART 2 (LANE GROUP ADJUSTMENTS)
DIR LN GROUP   FLOW N   LU     v  Plt  Prt
EB  LT           25 1 1.00    25 1.00 0.00
EB  TH-RT       104 1 1.00   104 0.00 0.19
WB  LT          159 1 1.00   159 1.00 0.00
WB  TH-RT       248 1 1.00   248 0.00 0.64
NB  LT           39 1 1.00    39 1.00 0.00
NB  TH         1229 1 1.00  1229 0.00 0.00
NB  RT          308 1 1.00   308 0.00 1.00
SB  LT          224 1 1.00   224 1.00 0.00
SB  TH          491 1 1.00   491 0.00 0.00
SB  RT           60 1 1.00    60 0.00 1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)
LEFT TURN                OPPOSING APPROACH
BEING OPPOSED        VOLUMES         % OPPOSING LEFT TURN      # LANES       OPPOSING
                 LT    TH    RT        LT    TH    RT        LT  TH  RT      VOLUME
EASTBOUND       159    89   160       100   100   100         1   1   0        248
WESTBOUND        25    84    20       100   100   100         1   1   0        104
NORTHBOUND      224   491    60       100   100     0         1   1   1        491
SOUTHBOUND       39  1229   308       100   100     0         1   1   1       1229

SATURATION FLOW ADJUSTMENT WORKSHEET
DIR LN GROUP  IDEAL N  Fwid    Fhv    Fgr Fpark  Fbus Farea   Frt   Flt     s
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```
EB  LT          1800  1 0.933 1.000 1.000 1.000 1.000 0.900 1.000 0.364  550
EB  TH-RT       1800  1 0.933 1.000 1.000 1.000 1.000 0.900 0.971 1.000 1468
WB  LT          1800  1 1.000 0.995 1.000 1.000 1.000 0.900 1.000 0.727 1173
WB  TH-RT       1800  1 0.967 0.995 1.000 1.000 1.000 0.900 0.903 1.000 1408
NB  LT          1800  1 0.967 0.990 1.000 1.000 1.000 0.900 1.000 0.505  784
NB  TH          1800  1 1.000 0.990 1.000 1.000 1.000 0.900 1.000 1.000 1604
NB  RT          1800  1 0.933 0.990 1.000 1.000 0.996 0.900 0.850 1.000 1267
SB  LT          1800  1 1.000 0.995 1.000 1.000 1.000 0.900 1.000 0.091  147
SB  TH          1800  1 0.933 0.995 1.000 1.000 1.000 0.900 1.000 1.000 1504
SB  RT          1800  1 0.867 0.995 1.000 1.000 0.996 0.900 0.850 1.000 1183

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES
DIR  C   G  N   Va   Vm  Vlt  Plt No   Vo Plto
EB 100  11  1   25  104   25 1.00  1  248 0.00
WB 100  11  1  159  248  159 1.00  1  104 0.00
NB 100  79  1   39 1399   39 1.00  1  491 0.00
SB 100  79  1  224  551  224 1.00  1 1229 0.00
CALCULATIONS
DIR Sop   Yo     Gu    Fs    Pl     Gq    Pt     Gf        El    Fm   Flt
EB 1800 0.138  0.000 0.720 1.000 11.000 0.000  0.000     1.563 0.364 0.364
WB 1800 0.058  5.556 0.810 1.000  5.444 0.000  0.000     1.389 0.727 0.727
NB 1800 0.273 71.129 0.568 1.000  7.871 0.000  0.000     1.980 0.505 0.505
SB 1800 0.683 33.776 0.107 1.000 45.224 0.000  0.000    10.539 0.091 0.091

CAPACITY ANALYSIS WORKSHEET
DIR LN GROUP    v    s  v/s  g/C    c  v/c  CRITICAL
EB  LT         25  550 0.05 0.11   60 0.41
EB  TH-RT     104 1468 0.07 0.11  162 0.64
WB  LT        159 1173 0.14 0.11  129 1.23
WB  TH-RT     248 1408 0.18 0.11  155 1.60     *
NB  LT         39  784 0.05 0.79  619 0.06
NB  TH       1229 1604 0.77 0.79 1267 0.97
NB  RT        308 1267 0.24 0.79 1001 0.31
SB  LT        224  147 1.52 0.79  116 1.93     *
SB  TH        491 1504 0.33 0.79 1189 0.41
SB  RT         60 1183 0.05 0.79  934 0.06

CYCLE=100.0  LOST=10.0  SUM V/S CRIT= 1.70 TOTAL V/C= 1.89

LEVEL OF SERVICE WORKSHEET
DIR LN GROUP  v/c  g/C    C      d1     c      d2   PF   Delay LOS Avg Q  95% Q
EB  LT       0.41 0.11 100.0  31.53    60    2.57 0.85   28.98  D    0.6
EB  TH-RT    0.64 0.11 100.0  32.39   162    5.71 0.85   32.39  D    2.6
WB  LT       1.23 0.11 100.0  34.81   129  178.72 0.85  181.50  F   10.0
WB  TH-RT    1.60 0.11 100.0  36.54   155  591.85 0.85  534.14  F   39.9
NB  LT       0.06 0.79 100.0   1.76   619    0.00 0.85    1.50  A    0.2
NB  TH       0.97 0.79 100.0   7.17  1267   13.79 0.85   17.82  C    9.7
NB  RT       0.31 0.79 100.0   2.21  1001    0.06 0.85    1.93  A    1.8
SB  LT       1.93 0.79 100.0 %1675.80  116 1275.04 0.85 2508.21  F 156.5
SB  TH       0.41 0.79 100.0   2.49  1189    0.14 0.85    2.23  A    2.9
SB  RT       0.06 0.79 100.0   1.77   934    0.00 0.85    1.50  A    0.3

DIR Delay  LOS
EB  31.73  D
WB 396.67  F
NB  14.31  B
SB 726.27  F
INTERSECTION DELAY =259.97 INTERSECTION LOS=F

THE CYCLE LENGTH WITHIN THE BOUNDS OF  100  TO  100 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 100.0 SECONDS

THE V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
for chosen cycle length 100.0
suggested timing phase 1 is  80.7 secs green,   5.0 secs yellow + red clear
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suggested timing phase 2 is   9.3 secs green,   5.0 secs yellow + red clear
suggested timing phase 3 is   0.0 secs green,   0.0 secs yellow + red clear
```

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
BROOKLINE AVE/FRANCIS ST.
3-PM 98 BUILD
date:05-09-1994 time:13:30:49
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=3PM98B GEOMETRICS=3PM98B SIGNAL=3PM98B
LOCATED IN CBD:Y
VOLUME & GEOMETRICS

DIR	VOLUMES LT	TH	RT	# OF LANES LT	TH	RT	LANE WIDTH LT	TH	RT	CROSS WALK
EB	18	40	105	0	1	0	0.0	15.0	0.0	40
WB	372	109	179	1	1	0	11.0	12.0	0.0	40
NB	21	468	200	1	1	1	11.0	12.0	10.0	60
SB	124	923	32	1	1	0	12.0	15.0	0.0	60

TRAFFIC & ROADWAY CONDITIONS

DIR	GRADE	%HV	ADJ PARK Y/N	MOVES	BUSES	PHF	PEDESTRIANS CROSS	BUT	MIN TIME	ARR TYPE
EB	0.0%	2.0%	N	0	0	.930	64	Y	17.0	3
WB	0.0%	1.0%	N	0	0	.950	96	Y	17.0	3
NB	0.0%	1.0%	Y	0	1	.930	53	Y	22.0	3
SB	0.0%	2.0%	Y	0	1	.900	67	Y	22.0	3

PHASINGS

	EASTBOUND l	t	r	p	WESTBOUND l	t	r	p	NORTHBOUND l	t	r	p	SOUTHBOUND l	t	r	p	GREEN	Y+R	PRE/ACT
1									*	*	*		*	*	*		75.0	5	A
2	*	*	*		*	*	*										35.0	5	A
3				*				*				*				*	0.0	0	A

CYCLE= 120.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	18	40	105	.930	19	43	113
WB	372	109	179	.950	392	115	188
NB	21	468	200	.930	23	503	215
SB	124	923	32	.900	138	1026	36

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH-RT	175	1	1.00	175	0.11	0.64
WB	LT	392	1	1.00	392	1.00	0.00
WB	TH-RT	303	1	1.00	303	0.00	0.62
NB	LT	23	1	1.00	23	1.00	0.00
NB	TH	503	1	1.00	503	0.00	0.00
NB	RT	215	1	1.00	215	0.00	1.00
SB	LT	138	1	1.00	138	1.00	0.00
SB	TH-RT	1061	1	1.00	1061	0.00	0.03

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES LT	TH	RT	% OPPOSING LEFT TURN LT	TH	RT	# LANES LT	TH	RT	OPPOSING VOLUME
EASTBOUND	392	115	188	100	100	100	1	1	0	303
WESTBOUND	19	43	113	100	100	100	0	1	0	156
NORTHBOUND	138	1026	36	100	100	100	1	1	0	1061
SOUTHBOUND	23	503	215	100	100	0	1	1	1	503

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH-RT	1800	1	1.100	0.990	1.000	1.000	1.000	0.900	0.797	0.830	1167
WB	LT	1800	1	0.967	0.995	1.000	1.000	1.000	0.900	1.000	0.634	988

WB	TH-RT	1800	1	1.000	0.995	1.000	1.000	1.000	0.900	0.907	1.000	1462
NB	LT	1800	1	0.967	0.995	1.000	1.000	1.000	0.900	1.000	0.079	124
NB	TH	1800	1	1.000	0.995	1.000	1.000	1.000	0.900	1.000	1.000	1612
NB	RT	1800	1	0.933	0.995	1.000	1.000	0.996	0.900	0.850	1.000	1273
SB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	0.900	1.000	0.436	699
SB	TH-RT	1800	1	1.100	0.990	1.000	1.000	0.996	0.900	0.995	1.000	1748

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	120	35	1	175	156	19	0.11	1	303	0.00
WB	120	35	1	392	303	392	1.00	1	156	0.11
NB	120	75	1	23	718	23	1.00	1	1061	0.00
SB	120	75	1	138	1061	138	1.00	1	503	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	1800	0.168	17.785	0.686	0.110	17.215	0.890	10.227	1.641	0.830	0.830
WB	1681	0.093	26.310	0.778	1.000	8.690	0.000	0.000	1.447	0.634	0.634
NB	1800	0.590	10.376	0.212	1.000	64.624	0.000	0.000	5.311	0.079	0.079
SB	1800	0.280	57.537	0.560	1.000	17.463	0.000	0.000	2.007	0.436	0.436

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH-RT	175	1167	0.15	0.29	340	0.51	
WB	LT	392	988	0.40	0.29	288	1.36	*
WB	TH-RT	303	1462	0.21	0.29	426	0.71	
NB	LT	23	124	0.18	0.63	77	0.29	
NB	TH	503	1612	0.31	0.63	1007	0.50	
NB	RT	215	1273	0.17	0.63	796	0.27	
SB	LT	138	699	0.20	0.63	437	0.32	
SB	TH-RT	1061	1748	0.61	0.63	1093	0.97	*

CYCLE=120.0 LOST=10.0 SUM V/S CRIT= 1.00 TOTAL V/C= 1.09

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH-RT	0.51	0.29	120.0	26.92	340	1.12	0.85	23.83	C	4.1	
WB	LT	1.36	0.29	120.0	37.91	288	259.47	0.85	252.77	F	32.1	
WB	TH-RT	0.71	0.29	120.0	28.87	426	3.76	0.85	27.73	D	7.2	
NB	LT	0.29	0.63	120.0	7.84	77	0.61	0.85	7.19	B	0.3	
NB	TH	0.50	0.63	120.0	9.32	1007	0.34	0.85	8.21	B	6.3	
NB	RT	0.27	0.63	120.0	7.72	796	0.05	0.85	6.60	B	2.7	
SB	LT	0.32	0.63	120.0	7.99	437	0.14	0.85	6.91	B	1.7	
SB	TH-RT	0.97	0.63	120.0	16.32	1093	15.32	0.85	26.89	D	14.6	

DIR	Delay	LOS
EB	23.83	C
WB	154.57	F
NB	7.71	B
SB	24.59	C

INTERSECTION DELAY = 52.23 INTERSECTION LOS=E

THE CYCLE LENGTH WITHIN THE BOUNDS OF 120 TO 120 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 120.0 SECONDS

THE V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
for chosen cycle length 120.0
suggested timing phase 1 is 66.5 secs green, 5.0 secs yellow + red clear
suggested timing phase 2 is 43.5 secs green, 5.0 secs yellow + red clear
suggested timing phase 3 is 0.0 secs green, 0.0 secs yellow + red clear

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
4- BROOKLINE AVE/DEACONESS RD
4- BUILD 98 AM
date:05-09-1994 time:15:50:35
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=4AM98B GEOMETRICS=4AM98B SIGNAL=4AM98B
LOCATED IN CBD:Y

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	38	11	79	0	1	0	0.0	15.0	0.0	40
WB	34	0	77	0	1	0	0.0	12.0	0.0	40
NB	14	1142	83	0	2	0	0.0	11.0	0.0	60
SB	99	631	2	1	1	0	10.0	15.0	0.0	60

TRAFFIC & ROADWAY CONDITIONS

			ADJ	PARK			PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	1.0%	N	0	0	.880	73	Y	17.0	3
WB	0.0%	1.0%	N	0	0	.750	138	Y	17.0	3
NB	0.0%	0.2%	Y	0	1	.840	33	Y	22.0	3
SB	0.0%	8.0%	Y	0	1	.840	129	Y	22.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1									*	*	*		*	*	*		67.0	5	A
2	*	*	*		*	*	*										8.0	5	A

CYCLE= 85.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	38	11	79	.880	43	13	90
WB	34	0	77	.750	45	0	103
NB	14	1142	83	.840	17	1360	99
SB	99	631	2	.840	118	751	2

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH-RT	145	1	1.00	145	0.30	0.62
WB	LT-RT	148	1	1.00	148	0.31	0.69
NB	LT-TH-RT	1475	2	1.05	1549	0.01	0.07
SB	LT	118	1	1.00	118	1.00	0.00
SB	TH-RT	754	1	1.00	754	0.00	0.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	45	0	103	100	100	100	0	1	0	103
WESTBOUND	43	13	90	100	100	100	0	1	0	102
NORTHBOUND	118	751	2	100	100	100	1	1	0	754
SOUTHBOUND	17	1360	99	100	100	100	0	2	0	1399

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH-RT	1800	1	1.100	0.995	1.000	1.000	1.000	0.900	0.807	0.990	1416
WB	LT-RT	1800	1	1.000	0.995	1.000	1.000	1.000	0.900	0.764	0.752	925
NB	LT-TH-RT	1800	2	0.967	0.999	1.000	1.000	0.998	0.900	0.990	0.975	3014
SB	LT	1800	1	0.933	0.962	1.000	1.000	1.000	0.900	1.000	0.060	87
SB	TH-RT	1800	1	1.100	0.962	1.000	1.000	0.996	0.900	1.000	1.000	1706

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

```
INPUT VARIABLES
DIR  C    G  N    Va    Vm   Vlt  Plt No    Vo Plto
EB  85    8  1   145   102    43 0.30  1   103 0.31
WB  85    8  1   148   103    45 0.31  1   102 0.30
NB  85   67  2  1475  1399    17 0.01  1   754 0.00
SB  85   67  1   118   754   118 1.00  2  1399 0.01
CALCULATIONS
DIR Sop     Yo      Gu     Fs     Pl      Gq     Pt      Gf         El     Fm    Flt
EB 1609 0.064   2.753 0.811 0.297   5.247 0.703   2.857      1.387 0.990 0.990
WB 1614 0.063   2.792 0.811 1.000   5.208 0.000   0.000      1.387 0.752 0.752
NB 1800 0.419  54.038 0.404 0.040  12.962 0.960  11.156      2.785 0.950 0.975
SB 3529 0.396  55.177 0.001 1.000  11.823 0.000   0.000   1800.000 0.060 0.060

CAPACITY ANALYSIS WORKSHEET
DIR LN GROUP     v     s  v/s  g/C     c  v/c  CRITICAL
EB  LT-TH-RT   145  1416 0.10 0.09   133 1.09
WB  LT-RT      148   925 0.16 0.09    87 1.70      *
NB  LT-TH-RT  1549  3014 0.51 0.79  2376 0.65
SB  LT         118    87 1.35 0.79    69 1.71      *
SB  TH-RT      754  1706 0.44 0.79  1344 0.56

CYCLE= 85.0  LOST=10.0  SUM V/S CRIT= 1.51 TOTAL V/C= 1.71

LEVEL OF SERVICE WORKSHEET
DIR LN GROUP  v/c  g/C    C       d1     c      d2    PF   Delay LOS Avg Q  95% Q
EB  LT-TH-RT 1.09 0.09  85.0   29.54   133    95.60 0.85  106.37  F    5.9
WB  LT-RT    1.70 0.09  85.0   31.55    87   796.81 0.85  704.11  F   30.5
NB  LT-TH-RT 0.65 0.79  85.0    2.98  2376     0.46 0.85    2.92  A    7.4
SB  LT       1.71 0.79  85.0 %1448.47    69  838.46 0.85 1943.89  F   63.9
SB  TH-RT    0.56 0.79  85.0    2.60  1344     0.41 0.85    2.55  A    3.8

DIR Delay LOS
EB 106.37  F
WB 704.11  F
NB   2.92  A
SB 265.11  F
INTERSECTION DELAY =130.91 INTERSECTION LOS=F

THE CYCLE LENGTH WITHIN THE BOUNDS OF  85  TO  85 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS  85.0 SECONDS

THE V/C RATIO CAN'T BE .95 FOR THE GIVEN CONDITIONS
for chosen cycle length  85.0
suggested timing phase 1 is  67.0 secs green,   5.0 secs yellow + red clear
suggested timing phase 2 is   8.0 secs green,   5.0 secs yellow + red clear
```

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
BROOKLINE AVE/DEACONESS RD.
4-PM 98 BUILD
date:05-09-1994 time:15:55:29
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=4PM98B GEOMETRICS=4PM98B SIGNAL=4PM98B
LOCATED IN CBD:Y

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	28	16	102	0	1	0	0.0	15.0	0.0	40
WB	111	0	126	0	1	0	0.0	12.0	0.0	40
NB	23	736	29	0	2	0	0.0	11.0	0.0	60
SB	52	810	20	1	1	0	10.0	15.0	0.0	60

TRAFFIC & ROADWAY CONDITIONS

			ADJ	PARK			PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.880	131	Y	17.0	3
WB	0.0%	10.0%	N	0	0	.750	122	Y	17.0	3
NB	0.0%	2.0%	Y	0	1	.980	36	Y	22.0	3
SB	0.0%	2.0%	N	0	1	.900	128	Y	22.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1									*	*	*		*	*	*		50.0	5	A
2	*	*	*		*		*										35.0	5	A
3				*				*				*				*	0.0	0	A

CYCLE= 95.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	28	16	102	.880	32	18	116
WB	111	0	126	.750	148	0	168
NB	23	736	29	.980	23	751	30
SB	52	810	20	.900	58	900	22

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH-RT	166	1	1.00	166	0.19	0.70
WB	LT-RT	316	1	1.00	316	0.47	0.53
NB	LT-TH-RT	804	2	1.05	844	0.03	0.04
SB	LT	58	1	1.00	58	1.00	0.00
SB	TH-RT	922	1	1.00	922	0.00	0.02

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	148	0	168	100	0	100	0	1	0	168
WESTBOUND	32	18	116	100	100	100	0	1	0	134
NORTHBOUND	58	900	22	100	100	100	1	1	0	922
SOUTHBOUND	23	751	30	100	100	100	0	2	0	804

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH-RT	1800	1	1.100	0.990	1.000	1.000	1.000	0.900	0.794	0.922	1291
WB	LT-RT	1800	1	1.000	0.952	1.000	1.000	1.000	0.900	0.796	0.711	873
NB	LT-TH-RT	1800	2	0.967	0.990	1.000	1.000	0.998	0.900	0.994	0.587	1805
SB	LT	1800	1	0.933	0.990	1.000	1.000	1.000	0.900	1.000	0.316	473
SB	TH-RT	1800	1	1.100	0.990	1.000	1.000	0.996	0.900	0.996	1.000	1751

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	95	35	1	166	134	32	0.19	1	168	0.47
WB	95	35	1	316	168	148	0.47	1	134	0.19
NB	95	50	2	804	804	23	0.03	1	922	0.00
SB	95	50	1	58	922	58	1.00	2	804	0.03

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	1503	0.112	27.449	0.770	0.192	7.551	0.808	4.656	1.461	0.922	0.922
WB	1654	0.081	29.706	0.791	1.000	5.294	0.000	0.000	1.422	0.711	0.711
NB	1800	0.512	2.722	0.299	0.304	47.278	0.696	4.581	3.767	0.173	0.587
SB	3331	0.241	35.680	0.372	1.000	14.320	0.000	0.000	3.021	0.316	0.316

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH-RT	166	1291	0.13	0.37	476	0.35	
WB	LT-RT	316	873	0.36	0.37	322	0.98	*
NB	LT-TH-RT	844	1805	0.47	0.53	950	0.89	
SB	LT	58	473	0.12	0.53	249	0.23	
SB	TH-RT	922	1751	0.53	0.53	921	1.00	*

CYCLE= 95.0 LOST=10.0 SUM V/S CRIT= 0.89 TOTAL V/C= 0.99

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH-RT	0.35	0.37	95.0	16.52	476	0.19	0.85	14.21	B	2.8	
WB	LT-RT	0.98	0.37	95.0	22.57	322	34.04	0.85	48.12	E	6.9	
NB	LT-TH-RT	0.89	0.53	95.0	15.22	950	7.38	0.85	19.20	C	10.1	
SB	LT	0.23	0.53	95.0	9.23	249	0.09	0.85	7.92	B	0.7	
SB	TH-RT	1.00	0.53	95.0	17.12	921	23.00	0.85	34.10	D	14.5	

DIR	Delay	LOS
EB	14.21	B
WB	48.12	E
NB	19.20	C
SB	32.56	D

INTERSECTION DELAY = 28.48 INTERSECTION LOS=D

THE CYCLE LENGTH WITHIN THE BOUNDS OF 95 TO 95 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 95.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 154.9 SECONDS
for chosen cycle length 95.0
suggested timing phase 1 is 50.4 secs green, 5.0 secs yellow + red clear
suggested timing phase 2 is 34.6 secs green, 5.0 secs yellow + red clear
suggested timing phase 3 is 0.0 secs green, 0.0 secs yellow + red clear

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
BROOKLINE AVE/LONGWOOD AVE
6-AM 98 BUILD
date:05-09-1994 time:13:36:07
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=6AM98B GEOMETRICS=6AM98B SIGNAL=6AM98B
LOCATED IN CBD:Y

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	74	365	44	1	1	0	10.0	11.0	0.0	40
WB	69	170	191	1	1	1	10.0	12.0	12.0	40
NB	87	922	274	1	2	0	11.0	12.0	0.0	60
SB	267	627	188	1	2	0	11.0	12.0	0.0	60

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK				PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	13.0%	N	0	0	.840	10	Y	17.0	3
WB	1.0%	5.0%	N	0	0	.880	10	Y	17.0	3
NB	0.0%	6.0%	N	0	0	.980	35	Y	22.0	3
SB	0.0%	2.0%	N	0	0	.980	30	Y	22.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*										31.0	5	A
2													*	*	*		12.0	0	A
3									*	*	*		*	*	*		42.0	5	A
4				*				*				*				*	0.0	0	A

CYCLE= 95.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	74	365	44	.840	88	435	52
WB	69	170	191	.880	78	193	217
NB	87	922	274	.980	89	941	280
SB	267	627	188	.980	272	640	192

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	88	1	1.00	88	1.00	0.00
EB	TH-RT	487	1	1.00	487	0.00	0.11
WB	LT	78	1	1.00	78	1.00	0.00
WB	TH	193	1	1.00	193	0.00	0.00
WB	RT	217	1	1.00	217	0.00	1.00
NB	LT	89	1	1.00	89	1.00	0.00
NB	TH-RT	1220	2	1.05	1281	0.00	0.23
SB	LT	272	1	1.00	272	1.00	0.00
SB	TH-RT	832	2	1.05	873	0.00	0.23

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	78	193	217	100	100	0	1	1	1	193
WESTBOUND	88	435	52	100	100	100	1	1	0	487
NORTHBOUND	272	640	192	0	78	78	1	2	0	647
SOUTHBOUND	89	941	280	100	100	100	1	2	0	1220

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s

```
EB  LT          1800  1 0.933 0.939 1.000 1.000 1.000 0.900 1.000 0.633  899
EB  TH-RT       1800  1 0.967 0.939 1.000 1.000 1.000 0.900 0.984 1.000 1447
WB  LT          1800  1 0.933 0.976 0.995 1.000 1.000 0.900 1.000 0.248  364
WB  TH          1800  1 1.000 0.976 0.995 1.000 1.000 0.900 1.000 1.000 1573
WB  RT          1800  1 1.000 0.976 0.995 1.000 1.000 0.900 0.850 1.000 1337
NB  LT          1800  1 0.967 0.971 1.000 1.000 1.000 0.900 1.000 0.398  605
NB  TH-RT       1800  2 1.000 0.971 1.000 1.000 1.000 0.900 0.966 1.000 3038
SB  LT          1800  1 0.967 0.990 1.000 1.000 1.000 0.900 1.000 0.950 1473
SB  TH-RT       1800  2 1.000 0.990 1.000 1.000 1.000 0.900 0.965 1.000 3097

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES
DIR  C    G   N    Va   Vm   Vlt  Plt No   Vo Plto
EB  95   31   1    88  487    88 1.00  1  193 0.00
WB  95   31   1    78  410    78 1.00  1  487 0.00
NB  95   42   1    89 1220    89 1.00  2  647 0.00
CALCULATIONS
DIR Sop    Yo     Gu    Fs    Pl     Gq    Pt     Gf        El    Fm   Flt
EB 1800 0.107 23.306 0.754 1.000  7.694 0.000  0.000     1.492 0.633 0.633
WB 1800 0.271  7.268 0.571 1.000 23.732 0.000  0.000     1.971 0.248 0.248
NB 3600 0.180 30.392 0.471 1.000 11.608 0.000  0.000     2.390 0.398 0.398

CAPACITY ANALYSIS WORKSHEET
DIR LN GROUP     v    s  v/s  g/C    c  v/c  CRITICAL
EB  LT          88  899 0.10 0.33  293 0.30
EB  TH-RT      487 1447 0.34 0.33  472 1.03     *
WB  LT          78  364 0.22 0.33  119 0.66
WB  TH         193 1573 0.12 0.33  513 0.38
WB  RT         217 1337 0.16 0.33  436 0.50
NB  LT          89  605 0.15 0.44  268 0.33
NB  TH-RT     1281 3038 0.42 0.44 1343 0.95     *
SB  LT         272 1473 0.12 0.13  275 0.99     *
SB  TH-RT      873 3097 0.28 0.57 1760 0.50

CYCLE= 95.0  LOST=10.0  SUM V/S CRIT= 0.88 TOTAL V/C= 0.99
FOR THE SOUTHBOUND PROTECTED/PERMISSIVE LEFT TURN LANE THE CAPACITY, V/S AND V
 RATIOS HAVE ALL BEEN ADJUSTED TO REFLECT A CAPACITY FOR
 65 LEFT TURNS ON THE CHANGE INTERVAL AND  24 ON THE PERMISSIVE PHASE

LEVEL OF SERVICE WORKSHEET
DIR LN GROUP  v/c  g/C    C     d1     c     d2   PF   Delay LOS Avg Q  95% Q
EB  LT        0.30 0.33  95.0  18.16  293    0.18 0.85  15.59  C    1.6
EB  TH-RT     1.03 0.33  95.0  24.70  472   40.67 0.85  55.56  E   11.8
WB  LT        0.66 0.33  95.0  20.88  119    8.47 0.85  24.95  C    1.4
WB  TH        0.38 0.33  95.0  18.68  513    0.23 0.85  16.07  C    3.4
WB  RT        0.50 0.33  95.0  19.56  436    0.76 0.85  17.28  C    3.9
NB  LT        0.33 0.44  95.0  13.17  268    0.28 0.85  11.43  B    1.3
NB  TH-RT     0.95 0.44  95.0  19.43 1343   11.07 0.85  25.93  D   18.0
SB  LT        0.99 0.57  95.0  15.36  275   38.74 1.00  54.10  E    7.2
SB  TH-RT     0.50 0.57  95.0   9.36 1760    0.19 0.85   8.12  B    9.5

DIR Delay LOS
EB  49.44  E
WB  18.03  C
NB  24.99  C
SB  19.06  C
INTERSECTION DELAY = 26.07 INTERSECTION LOS=D

THE CYCLE LENGTH WITHIN THE BOUNDS OF  95  TO  95 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS  95.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 142.6 SECONDS
for chosen cycle length  95.0
suggested timing phase 1 is  32.4 secs green,   5.0 secs yellow + red clear
suggested timing phase 2 is  12.0 secs green,   0.0 secs yellow + red clear
suggested timing phase 3 is  40.6 secs green,   5.0 secs yellow + red clear
```

suggested timing phase 4 is 0.0 secs green, 0.0 secs yellow + red clear

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
BROOKLINE AVE/LONGWOOD AVE
6-PM 98 BUILD
date:05-09-1994 time:13:39:06
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=6PM98B GEOMETRICS=6PM98B SIGNAL=6PM98B
LOCATED IN CBD:Y

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	93	262	61	1	1	0	10.0	11.0	0.0	40
WB	184	307	324	1	1	1	10.0	12.0	12.0	40
NB	64	713	96	1	2	0	11.0	12.0	0.0	60
SB	277	654	143	1	2	0	11.0	12.0	0.0	60

TRAFFIC & ROADWAY CONDITIONS

			ADJ	PARK			PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	13.0%	N	0	0	.840	10	Y	17.0	3
WB	1.0%	5.0%	N	0	0	.880	10	Y	17.0	3
NB	0.0%	6.0%	N	0	0	.980	35	Y	22.0	3
SB	0.0%	2.0%	N	0	0	.980	30	Y	22.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*										53.0	5	A
2													*	*	*		18.0	0	A
3									*	*	*		*	*	*		39.0	5	A
4				*				*				*				*	0.0	0	A

CYCLE= 120.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	93	262	61	.840	111	312	73
WB	184	307	324	.880	209	349	368
NB	64	713	96	.980	65	728	98
SB	277	654	143	.980	283	667	146

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	111	1	1.00	111	1.00	0.00
EB	TH-RT	385	1	1.00	385	0.00	0.19
WB	LT	209	1	1.00	209	1.00	0.00
WB	TH	349	1	1.00	349	0.00	0.00
WB	RT	368	1	1.00	368	0.00	1.00
NB	LT	65	1	1.00	65	1.00	0.00
NB	TH-RT	826	2	1.05	867	0.00	0.12
SB	LT	283	1	1.00	283	1.00	0.00
SB	TH-RT	813	2	1.05	854	0.00	0.18

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	209	349	368	100	100	0	1	1	1	349
WESTBOUND	111	312	73	100	100	100	1	1	0	385
NORTHBOUND	283	667	146	0	68	68	1	2	0	556
SOUTHBOUND	65	728	98	100	100	100	1	2	0	826

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s

EB	LT	1800	1	0.933	0.939	1.000	1.000	1.000	0.900	1.000	0.482	684
EB	TH-RT	1800	1	0.967	0.939	1.000	1.000	1.000	0.900	0.972	1.000	1429
WB	LT	1800	1	0.933	0.976	0.995	1.000	1.000	0.900	1.000	0.446	654
WB	TH	1800	1	1.000	0.976	0.995	1.000	1.000	0.900	1.000	1.000	1573
WB	RT	1800	1	1.000	0.976	0.995	1.000	1.000	0.900	0.850	1.000	1337
NB	LT	1800	1	0.967	0.971	1.000	1.000	1.000	0.900	1.000	0.393	598
NB	TH-RT	1800	2	1.000	0.971	1.000	1.000	1.000	0.900	0.982	1.000	3090
SB	LT	1800	1	0.967	0.990	1.000	1.000	1.000	0.900	1.000	0.950	1473
SB	TH-RT	1800	2	1.000	0.990	1.000	1.000	1.000	0.900	0.973	1.000	3122

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	120	53	1	111	385	111	1.00	1	349	0.00
WB	120	53	1	209	717	209	1.00	1	385	0.00
NB	120	39	1	65	826	65	1.00	2	556	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	1800	0.194	36.893	0.657	1.000	16.107	0.000	0.000	1.712	0.482	0.482
WB	1800	0.214	34.799	0.635	1.000	18.201	0.000	0.000	1.773	0.446	0.446
NB	3600	0.155	24.191	0.527	1.000	14.809	0.000	0.000	2.134	0.393	0.393

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	111	684	0.16	0.44	302	0.37	
EB	TH-RT	385	1429	0.27	0.44	631	0.61	
WB	LT	209	654	0.32	0.44	289	0.72	*
WB	TH	349	1573	0.22	0.44	695	0.50	
WB	RT	368	1337	0.28	0.44	590	0.62	
NB	LT	65	598	0.11	0.33	194	0.34	
NB	TH-RT	867	3090	0.28	0.33	1004	0.86	*
SB	LT	283	1473	0.13	0.15	334	0.85	*
SB	TH-RT	854	3122	0.27	0.48	1483	0.58	

CYCLE=120.0 LOST=10.0 SUM V/S CRIT= 0.73 TOTAL V/C= 0.79
FOR THE SOUTHBOUND PROTECTED/PERMISSIVE LEFT TURN LANE THE CAPACITY, V/S AND V/C
RATIOS HAVE ALL BEEN ADJUSTED TO REFLECT A CAPACITY FOR
52 LEFT TURNS ON THE CHANGE INTERVAL AND 61 ON THE PERMISSIVE PHASE

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	0.37	0.44	120.0	16.96	302	0.35	0.85	14.71	B	2.1	
EB	TH-RT	0.61	0.44	120.0	19.45	631	1.24	0.85	17.59	C	7.2	
WB	LT	0.72	0.44	120.0	20.89	289	5.87	0.85	22.74	C	3.9	
WB	TH	0.50	0.44	120.0	18.27	695	0.50	0.85	15.95	C	6.5	
WB	RT	0.62	0.44	120.0	19.62	590	1.47	0.85	17.92	C	6.9	
NB	LT	0.34	0.33	120.0	23.32	194	0.40	0.85	20.17	C	1.5	
NB	TH-RT	0.86	0.33	120.0	28.88	1004	5.59	0.85	29.30	D	18.6	
SB	LT	0.85	0.48	120.0	21.01	334	12.32	1.00	33.33	D	8.0	
SB	TH-RT	0.58	0.48	120.0	17.30	1483	0.42	0.85	15.06	C	14.2	

DIR	Delay	LOS
EB	16.94	C
WB	18.27	C
NB	28.66	D
SB	19.60	C

INTERSECTION DELAY = 21.29 INTERSECTION LOS=C

THE CYCLE LENGTH WITHIN THE BOUNDS OF 120 TO 120 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 120.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 42.6 SECONDS
for chosen cycle length 120.0
suggested timing phase 1 is 48.3 secs green, 5.0 secs yellow + red clear
suggested timing phase 2 is 19.2 secs green, 0.0 secs yellow + red clear
suggested timing phase 3 is 42.5 secs green, 5.0 secs yellow + red clear

suggested timing phase 4 is   0.0 secs green,   0.0 secs yellow + red clear

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 1 OF 2)
DATE:05-09-1994 TIME:15:05:20
BINNEY ST./LONGWOOD AVE 1998 BUILD AM

LAST DATASETS LOADED OR SAVED
VOLUME=5AM98B GEOMETRICS=5AM98B

```
KEY:    D
        |
    A-  -B
        |
        C
```

GENERAL CHARACTERISTICS
POPULATION GREATER THAN 250,000: YES
CONTROLS: FROM C: STOP
FROM D: STOP
PREVAILING SPEED: 35 MPH
MAIN STREET # OF LANES: 4 LANES
MAIN STREET APPROACH A - EXCLUSIVE RIGHT TURN LANE: NO
MAIN STREET APPROACH B - EXCLUSIVE RIGHT TURN LANE: NO

MINOR STREET LANES

APPROACH: C: BINNEY NB
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

APPROACH: D: BINNEY SB
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

SIGHT DISTANCE RESTRICTIONS (in seconds)

APPROACH	A: LONGWOOD EB	B: LONGWOOD WB	C: BINNEY NB	D: BINNEY SB
LEFTS	0.00	0.00	0.00	0.00
THRUS	0.00	0.00	0.00	0.00
RIGHTS	0.00	0.00	0.00	0.00

APPROACH	A: LONGWOOD EB			B: LONGWOOD WB			C: BINNEY NB			D: BINNEY SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
VOLUME	298	565	108	107	332	84	65	73	172	9	7	29
PHF	0.82			0.85			0.86			0.75		
ADJ VOLUME	363	689	132	126	391	99	76	85	200	12	9	39
PERCENT GRADE	0.00			0.00			0.00					
PERCENT CYCLES		0.00			0.00			0.00			0.00	
PASSENGER CARS		93.00			92.00			92.00			91.00	
PERCENT LT TRU		7.00			8.00			8.00			9.00	
PERCENT HV TRU		0.00			0.00			0.00			0.00	
PASS CAR/HR	376			131			79	88	208	13	10	40

STEP 1 RIGHT TURNS FROM	C:BINNEY NB	D:BINNEY SB
CONFLICTING FLOWS	410	245
CRITICAL GAPS	5.2	5.2
CAPACITY	749	899
CAPACITY USED	28%	4%
IMPEDANCE FACTOR	0.79	0.98
ACTUAL CAPACITY	749	899

1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 2 OF 2)
DATE:05-09-1994 TIME:15:05:20
BINNEY ST./LONGWOOD AVE 1998 BUILD AM

STEP 2 LEFT TURNS FROM	B:LONGWOOD WB	A:LONGWOOD EB
CONFLICTING FLOWS	821	489
CRITICAL GAPS	5.1	5.1
CAPACITY	478	704
CAPACITY USED	27%	53%
IMPEDANCE FACTOR	0.79	0.54
ACTUAL CAPACITY	478	704

STEP 3 THRU MOVES FROM	C:BINNEY NB	D:BINNEY SB
CONFLICTING FLOWS	1734	1750
CRITICAL GAPS	6.3	6.3
CAPACITY	71	68
CAPACITY USED	125%	14%
IMPEDANCE FACTOR	0.00	0.91
ACTUAL CAPACITY	30	29

STEP 4 LEFT TURNS FROM	C:BINNEY NB	D:BINNEY SB
CONFLICTING FLOWS	1782	2035
CRITICAL GAPS	6.8	6.8
CAPACITY	49	29
ACTUAL CAPACITY	19	0

SUMMARY OF LEVEL OF SERVICE BY MOVEMENT

MOVEMENT	DEMAND	CAPACITY	RESERVE	LOS	AVG DEL(SEC)	AVG QUEUE
LT FROM A:	376	704	327	B	11.00	1.15
LT FROM B:	131	478	347	B	10.38	0.38
ALL MOVES FROM C:	375	51	-324	F	INFINITE	INFINITE
ALL MOVES FROM D:	63	0	-63	F	INFINITE	INFINITE

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 1 OF 2)
DATE:05-09-1994 TIME:14:46:35
BINNEY ST./LONGWOOD AVE 1998 BUILD PM

LAST DATASETS LOADED OR SAVED
VOLUME=5PM98B GEOMETRICS=5PM98B

```
KEY:   D
       |
   A-  |  -B
       |
       C
```

GENERAL CHARACTERISTICS
POPULATION GREATER THAN 250,000: YES
CONTROLS: FROM C: STOP
FROM D: STOP
PREVAILING SPEED: 35 MPH
MAIN STREET # OF LANES: 4 LANES
MAIN STREET APPROACH A - EXCLUSIVE RIGHT TURN LANE: NO
MAIN STREET APPROACH B - EXCLUSIVE RIGHT TURN LANE: NO

MINOR STREET LANES

APPROACH: C: BINNEY NB
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

APPROACH: D: BINNEY SB
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

SIGHT DISTANCE RESTRICTIONS (in seconds)

APPROACH	A: LONGWOOD EB	B: LONGWOOD WB	C: BINNEY NB	D: BINNEY SB
LEFTS	0.00	0.00	0.00	0.00
THRUS	0.00	0.00	0.00	0.00
RIGHTS	0.00	0.00	0.00	0.00

APPROACH	A: LONGWOOD EB			B: LONGWOOD WB			C: BINNEY NB			D: BINNEY SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
VOLUME	88	460	72	66	613	8	61	16	158	90	63	205
PHF	0.95			0.85			0.84			0.75		
ADJ VOLUME	93	484	76	78	721	9	73	19	188	120	84	273
PERCENT GRADE	0.00			0.00			0.00					
PERCENT CYCLES		0.00			0.00			0.00			0.00	
PASSENGER CARS		94.00			95.00			95.00			99.00	
PERCENT LT TRU		6.00			5.00			5.00			1.00	
PERCENT HV TRU		0.00			0.00			0.00			0.00	
PASS CAR/HR	95			80			74	20	193	121	84	275

STEP 1 RIGHT TURNS FROM	C:BINNEY NB	D:BINNEY SB
CONFLICTING FLOWS	280	365
CRITICAL GAPS	5.2	5.2
CAPACITY	865	788
CAPACITY USED	22%	35%
IMPEDANCE FACTOR	0.84	0.73
ACTUAL CAPACITY	865	788

1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 2 OF 2)
DATE:05-09-1994 TIME:14:46:35
BINNEY ST./LONGWOOD AVE 1998 BUILD PM

STEP 2 LEFT TURNS FROM	B:LONGWOOD WB	A:LONGWOOD EB
CONFLICTING FLOWS	560	731
CRITICAL GAPS	5.1	5.1
CAPACITY	650	532
CAPACITY USED	12%	18%
IMPEDANCE FACTOR	0.92	0.88
ACTUAL CAPACITY	650	532

STEP 3 THRU MOVES FROM	C:BINNEY NB	D:BINNEY SB
CONFLICTING FLOWS	1423	1456
CRITICAL GAPS	6.3	6.3
CAPACITY	123	116
CAPACITY USED	16%	73%
IMPEDANCE FACTOR	0.89	0.34
ACTUAL CAPACITY	100	94

STEP 4 LEFT TURNS FROM	C:BINNEY NB	D:BINNEY SB
CONFLICTING FLOWS	1780	1663
CRITICAL GAPS	6.8	6.8
CAPACITY	49	62
ACTUAL CAPACITY	10	38

SUMMARY OF LEVEL OF SERVICE BY MOVEMENT

MOVEMENT	DEMAND	CAPACITY	RESERVE	LOS	AVG DEL(SEC)	AVG QUEUE
LT FROM A:	95	532	437	A	8.24	0.22
LT FROM B:	80	650	570	A	6.32	0.14
ALL MOVES FROM C:	287	35	-251	F	INFINITE	INFINITE
ALL MOVES FROM D:	480	108	-372	F	INFINITE	INFINITE

Longwood Avenue/Binney Street Intersection: Capacity Analysis After Signal Installation

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CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
LONGWOOD/BINNEY
AM NB
date:05-14-1994              time:13:53:14
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=            GEOMETRICS=             SIGNAL=
LOCATED IN CBD:N
VOLUME & GEOMETRICS
        VOLUMES        # OF LANES      LANE WIDTH      CROSS
DIR  LT   TH   RT     LT TH RT       LT   TH   RT      WALK
EB  298  565   84      0  1  1      0.0 12.0 12.0       0
WB   67  332   84      0  2  0      0.0 12.0  0.0       0
NB   60   73  164      1  1  0     12.0 12.0  0.0       0
SB    9    7   29      0  1  1      0.0 12.0 12.0       0

TRAFFIC & ROADWAY CONDITIONS
                 ADJ PARK                 PEDESTRIANS        ARR
DIR GRADE %HV   Y/N MOVES BUSES  PHF CROSS BUT MIN TIME TYPE
EB  0.0%  0.0%   N      0     0  .900     0   N     7.0    3
WB  0.0%  0.0%   N      0     0  .900     0   N     7.0    3
NB  0.0%  0.0%   N      0     0  .900     0   N     7.0    3
SB  0.0%  0.0%   N      0     0  .900     0   N     7.0    3

PHASINGS
    EASTBOUND   WESTBOUND   NORTHBOUND  SOUTHBOUND GREEN  Y+R PRE/ACT
    l  t  r  p  l  t  r  p  l  t  r  p  l  t  r  p
 1  *  *  *     *  *  *                              47.7   3    P
 2                          *  *  *     *  *  *      11.3   3    P

CYCLE=  65.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)
DIR   LTV  THV  RTV   PHF  LTFR THFR RTFR
EB    298  565   84  .900   331  628   93
WB     67  332   84  .900    74  369   93
NB     60   73  164  .900    67   81  182
SB      9    7   29  .900    10    8   32

PART 2 (LANE GROUP ADJUSTMENTS)
DIR LN GROUP   FLOW N   LU    v  Plt  Prt
EB  LT-TH       959 1 1.00  959 0.35 0.00
EB  RT           93 1 1.00   93 0.00 1.00
WB  LT-TH-RT    537 2 1.05  563 0.14 0.17
NB  LT           67 1 1.00   67 1.00 0.00
NB  TH-RT       263 1 1.00  263 0.00 0.69
SB  LT-TH        18 1 1.00   18 0.56 0.00
SB  RT           32 1 1.00   32 0.00 1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)
LEFT TURN                 OPPOSING APPROACH
BEING OPPOSED       VOLUMES       % OPPOSING LEFT TURN    # LANES      OPPOSING
                 LT   TH   RT        LT   TH   RT        LT  TH  RT     VOLUME
EASTBOUND        74  369   93       100  100  100         0   2   0      537
WESTBOUND       331  628   93       100  100    0         0   1   1      628
NORTHBOUND       10    8   32       100  100    0         0   1   1        8
SOUTHBOUND       67   81  182       100  100  100         1   1   0      263

SATURATION FLOW ADJUSTMENT WORKSHEET
DIR LN GROUP   IDEAL N  Fwid   Fhv   Fgr Fpark  Fbus Farea   Frt   Flt    s
EB  LT-TH      1800  1 1.000 1.000 1.000 1.000 1.000 1.000 1.000 0.769 1385
EB  RT         1800  1 1.000 1.000 1.000 1.000 1.000 1.000 0.850 1.000 1530
WB  LT-TH-RT   1800  2 1.000 1.000 1.000 1.000 1.000 1.000 0.974 0.759 2661
NB  LT         1800  1 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1800
NB  TH-RT      1800  1 1.000 1.000 1.000 1.000 1.000 1.000 0.896 1.000 1613
```

SB	LT-TH	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.550	989
SB	RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.850	1.000	1530

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	65	48	1	959	721	331	0.35	2	537	0.14
WB	65	48	2	537	537	74	0.14	1	628	0.35
NB	65	11	1	67	263	67	1.00	1	8	0.56
SB	65	11	1	18	40	10	0.56	1	263	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	2929	0.183	43.876	0.540	0.345	3.870	0.655	2.121	2.085	0.769	0.769
WB	1309	0.479	31.857	0.483	0.472	15.890	0.528	2.224	2.331	0.518	0.759
NB	1355	0.006	10.943	0.870	1.000	0.310	0.000	0.000	1.293	1.000	1.000
SB	1800	0.146	2.043	0.710	0.563	9.210	0.438	1.521	1.584	0.550	0.550

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	959	1385	0.69	0.73	1017	0.94	*
EB	RT	93	1530	0.06	0.73	1124	0.08	
WB	LT-TH-RT	563	2661	0.21	0.73	1955	0.29	
NB	LT	67	1800	0.04	0.17	312	0.21	
NB	TH-RT	263	1613	0.16	0.17	279	0.94	*
SB	LT-TH	18	989	0.02	0.17	171	0.10	
SB	RT	32	1530	0.02	0.17	265	0.12	

CYCLE= 65.0 LOST= 6.0 SUM V/S CRIT= 0.86 TOTAL V/C= 0.94

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	0.94	0.73	65.0	5.66	1017	11.88	1.00	17.54	C	7.0	
EB	RT	0.08	0.73	65.0	1.85	1124	0.00	1.00	1.85	A	0.4	
WB	LT-TH-RT	0.29	0.73	65.0	2.21	1955	0.02	1.00	2.23	A	2.6	
NB	LT	0.21	0.17	65.0	17.54	312	0.06	1.00	17.59	C	1.0	
NB	TH-RT	0.94	0.17	65.0	20.18	279	28.03	1.00	48.21	E	5.5	
SB	LT-TH	0.10	0.17	65.0	17.20	171	0.01	1.00	17.21	C	0.3	
SB	RT	0.12	0.17	65.0	17.25	265	0.01	1.00	17.26	C	0.5	

DIR	Delay	LOS
EB	16.15	C
WB	2.23	A
NB	42.02	E
SB	17.24	C

INTERSECTION DELAY = 16.53 INTERSECTION LOS=C

THE CYCLE LENGTH WITHIN THE BOUNDS OF 65 TO 65 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 65.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 60.5 SECONDS
THE EXISTING TIMING IS OPTIMAL

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CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
LONGWOOD/BINNEY
AM BUILD
date:05-14-1994             time:13:54:28
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=            GEOMETRICS=            SIGNAL=
LOCATED IN CBD:N
VOLUME & GEOMETRICS
        VOLUMES        # OF LANES      LANE WIDTH      CROSS
DIR  LT    TH    RT    LT TH RT      LT    TH    RT    WALK
EB  298   565   108     0  1  1      0.0 12.0 12.0      0
WB  107   332    84     0  2  0      0.0 12.0  0.0      0
NB   65    73   172     1  1  0     12.0 12.0  0.0      0
SB    9     7    29     0  1  1      0.0 12.0 12.0      0

TRAFFIC & ROADWAY CONDITIONS
              ADJ PARK                PEDESTRIANS          ARR
DIR GRADE %HV   Y/N MOVES BUSES  PHF CROSS BUT MIN TIME TYPE
EB  0.0%  0.0%   N      0     0  .900    0   N      7.0    3
WB  0.0%  0.0%   N      0     0  .900    0   N      7.0    3
NB  0.0%  0.0%   N      0     0  .900    0   N      7.0    3
SB  0.0%  0.0%   N      0     0  .900    0   N      7.0    3

PHASINGS
    EASTBOUND    WESTBOUND    NORTHBOUND   SOUTHBOUND GREEN   Y+R PRE/ACT
    l  t  r  p  l  t  r  p  l  t  r  p  l  t  r  p
 1  *  *  *     *  *  *                                47.7   3    P
 2                          *  *  *     *  *  *        11.3   3    P

CYCLE=  65.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)
DIR  LTV  THV  RTV   PHF  LTFR THFR RTFR
EB   298  565  108  .900   331  628  120
WB   107  332   84  .900   119  369   93
NB    65   73  172  .900    72   81  191
SB     9    7   29  .900    10    8   32

PART 2 (LANE GROUP ADJUSTMENTS)
DIR LN GROUP   FLOW N   LU    v  Plt  Prt
EB  LT-TH       959 1 1.00  959 0.35 0.00
EB  RT          120 1 1.00  120 0.00 1.00
WB  LT-TH-RT    581 2 1.05  610 0.20 0.16
NB  LT           72 1 1.00   72 1.00 0.00
NB  TH-RT       272 1 1.00  272 0.00 0.70
SB  LT-TH        18 1 1.00   18 0.56 0.00
SB  RT           32 1 1.00   32 0.00 1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)
LEFT TURN                 OPPOSING APPROACH
BEING OPPOSED        VOLUMES        % OPPOSING LEFT TURN     # LANES      OPPOSING
                  LT    TH    RT        LT    TH    RT       LT  TH  RT     VOLUME
EASTBOUND        119   369    93       100   100   100        0   2   0      581
WESTBOUND        331   628   120       100   100     0        0   1   1      628
NORTHBOUND        10     8    32       100   100     0        0   1   1        8
SOUTHBOUND        72    81   191       100   100   100        1   1   0      272

SATURATION FLOW ADJUSTMENT WORKSHEET
DIR LN GROUP   IDEAL N  Fwid   Fhv   Fgr Fpark  Fbus Farea   Frt   Flt    s
EB  LT-TH      1800  1 1.000 1.000 1.000 1.000 1.000 1.000 1.000 0.743 1337
EB  RT         1800  1 1.000 1.000 1.000 1.000 1.000 1.000 0.850 1.000 1530
WB  LT-TH-RT   1800  2 1.000 1.000 1.000 1.000 1.000 1.000 0.976 0.712 2500
NB  LT         1800  1 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1800
```

NB	TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.895	1.000	1610
SB	LT-TH	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.525	945
SB	RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.850	1.000	1530

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	65	48	1	959	748	331	0.35	2	581	0.20
WB	65	48	2	581	581	119	0.20	1	628	0.35
NB	65	11	1	72	272	72	1.00	1	8	0.56
SB	65	11	1	18	40	10	0.56	1	272	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	2647	0.220	42.894	0.512	0.345	4.853	0.655	2.435	2.198	0.743	0.743
WB	1273	0.493	30.966	0.483	0.707	16.780	0.293	0.829	2.331	0.423	0.712
NB	1348	0.006	10.941	0.870	1.000	0.312	0.000	0.000	1.293	1.000	1.000
SB	1800	0.151	1.677	0.705	0.563	9.577	0.438	1.526	1.596	0.525	0.525

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	959	1337	0.72	0.73	982	0.98	*
EB	RT	120	1530	0.08	0.73	1124	0.11	
WB	LT-TH-RT	610	2500	0.24	0.73	1836	0.33	
NB	LT	72	1800	0.04	0.17	312	0.23	
NB	TH-RT	272	1610	0.17	0.17	279	0.98	*
SB	LT-TH	18	945	0.02	0.17	164	0.11	
SB	RT	32	1530	0.02	0.17	265	0.12	

CYCLE= 65.0 LOST= 6.0 SUM V/S CRIT= 0.89 TOTAL V/C= 0.98

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	0.98	0.73	65.0	6.15	982	17.25	1.00	23.40	C	8.5	
EB	RT	0.11	0.73	65.0	1.89	1124	0.00	1.00	1.89	A	0.6	
WB	LT-TH-RT	0.33	0.73	65.0	2.30	1836	0.04	1.00	2.34	A	2.8	
NB	LT	0.23	0.17	65.0	17.59	312	0.07	1.00	17.67	C	1.1	
NB	TH-RT	0.98	0.17	65.0	20.32	279	35.33	1.00	55.66	E	6.2	
SB	LT-TH	0.11	0.17	65.0	17.21	164	0.01	1.00	17.22	C	0.3	
SB	RT	0.12	0.17	65.0	17.25	265	0.01	1.00	17.26	C	0.5	

DIR	Delay	LOS
EB	21.01	C
WB	2.34	A
NB	47.69	E
SB	17.25	C

INTERSECTION DELAY = 19.86 INTERSECTION LOS=C

THE CYCLE LENGTH WITHIN THE BOUNDS OF 65 TO 65 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 65.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 89.3 SECONDS
THE EXISTING TIMING IS OPTIMAL

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
LONGWOOD/BINNEY
PM NB
date:05-14-1994 time:13:57:09
LAST DATA SET NAMES LOADED OR SAVED
VOLUME= GEOMETRICS= SIGNAL=
LOCATED IN CBD:N
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	88	460	69	0	1	1	0.0	12.0	12.0	0
WB	59	613	8	0	2	0	0.0	12.0	0.0	0
NB	38	16	119	1	1	0	12.0	12.0	0.0	0
SB	90	63	205	0	1	1	0.0	12.0	12.0	0

TRAFFIC & ROADWAY CONDITIONS

			ADJ	PARK			PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3
WB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3
NB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3
SB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*										47.7	3	P
2									*	*	*		*	*	*		11.3	3	P

CYCLE= 65.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	88	460	69	.900	98	511	77
WB	59	613	8	.900	66	681	9
NB	38	16	119	.900	42	18	132
SB	90	63	205	.900	100	70	228

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH	609	1	1.00	609	0.16	0.00
EB	RT	77	1	1.00	77	0.00	1.00
WB	LT-TH-RT	756	2	1.05	793	0.09	0.01
NB	LT	42	1	1.00	42	1.00	0.00
NB	TH-RT	150	1	1.00	150	0.00	0.88
SB	LT-TH	170	1	1.00	170	0.59	0.00
SB	RT	228	1	1.00	228	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	66	681	9	100	100	100	0	2	0	756
WESTBOUND	98	511	77	100	100	0	0	1	1	511
NORTHBOUND	100	70	228	100	100	0	0	1	1	70
SOUTHBOUND	42	18	132	100	100	100	1	1	0	150

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.820	1477
EB	RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.850	1.000	1530
WB	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	1.000	0.998	0.889	3196
NB	LT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.913	1643

NB	TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.868	1.000	1562
SB	LT-TH	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.842	1515
SB	RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.850	1.000	1530

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	65	48	1	609	588	98	0.16	2	756	0.09
WB	65	48	2	756	756	66	0.09	1	511	0.16
NB	65	11	1	42	150	42	1.00	1	70	0.59
SB	65	11	1	170	298	100	0.59	1	150	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	3256	0.232	42.534	0.403	0.161	5.213	0.839	3.830	2.793	0.820	0.820
WB	1398	0.366	37.799	0.556	0.249	9.948	0.751	4.577	2.025	0.779	0.889
NB	1430	0.049	8.487	0.831	1.000	2.767	0.000	0.000	1.353	0.913	0.913
SB	1800	0.083	6.367	0.781	0.588	4.886	0.412	1.240	1.440	0.842	0.842

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	609	1477	0.41	0.73	1085	0.56	*
EB	RT	77	1530	0.05	0.73	1124	0.07	
WB	LT-TH-RT	793	3196	0.25	0.73	2348	0.34	
NB	LT	42	1643	0.03	0.17	284	0.15	
NB	TH-RT	150	1562	0.10	0.17	270	0.55	
SB	LT-TH	170	1515	0.11	0.17	262	0.65	
SB	RT	228	1530	0.15	0.17	265	0.86	*

CYCLE= 65.0 LOST= 6.0 SUM V/S CRIT= 0.56 TOTAL V/C= 0.62

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	0.56	0.73	65.0	2.96	1085	0.51	1.00	3.47	A	2.9	
EB	RT	0.07	0.73	65.0	1.83	1124	0.00	1.00	1.83	A	0.4	
WB	LT-TH-RT	0.34	0.73	65.0	2.31	2348	0.03	1.00	2.35	A	3.6	
NB	LT	0.15	0.17	65.0	17.33	284	0.02	1.00	17.35	C	0.6	
NB	TH-RT	0.55	0.17	65.0	18.68	270	1.89	1.00	20.57	C	2.2	
SB	LT-TH	0.65	0.17	65.0	19.02	262	3.79	1.00	22.82	C	2.5	
SB	RT	0.86	0.17	65.0	19.84	265	16.30	1.00	36.14	D	4.0	

DIR	Delay	LOS
EB	3.29	A
WB	2.35	A
NB	19.86	C
SB	30.45	D

INTERSECTION DELAY = 9.69 INTERSECTION LOS=B

THE CYCLE LENGTH WITHIN THE BOUNDS OF 65 TO 65 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 65.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 14.7 SECONDS
for chosen cycle length 65.0
suggested timing phase 1 is 43.3 secs green,   3.0 secs yellow + red clear
suggested timing phase 2 is 15.7 secs green,   3.0 secs yellow + red clear

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
LONGWOOD/BINNEY
PM BUILD
date:05-14-1994 time:13:58:49
LAST DATA SET NAMES LOADED OR SAVED
VOLUME= GEOMETRICS= SIGNAL=
LOCATED IN CBD:N

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CROSS
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	WALK
EB	88	460	72	0	1	1	0.0	12.0	12.0	0
WB	66	613	8	0	2	0	0.0	12.0	0.0	0
NB	61	16	158	1	1	0	12.0	12.0	0.0	0
SB	90	63	205	0	1	1	0.0	12.0	12.0	0

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK				PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3
WB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3
NB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3
SB	0.0%	0.0%	N	0	0	.900	0	N	7.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*										47.7	3	P
2									*	*	*		*	*	*		11.3	3	P

CYCLE= 65.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	88	460	72	.900	98	511	80
WB	66	613	8	.900	73	681	9
NB	61	16	158	.900	68	18	176
SB	90	63	205	.900	100	70	228

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH	609	1	1.00	609	0.16	0.00
EB	RT	80	1	1.00	80	0.00	1.00
WB	LT-TH-RT	763	2	1.05	802	0.10	0.01
NB	LT	68	1	1.00	68	1.00	0.00
NB	TH-RT	193	1	1.00	193	0.00	0.91
SB	LT-TH	170	1	1.00	170	0.59	0.00
SB	RT	228	1	1.00	228	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH									
BEING OPPOSED	VOLUMES			% OPPOSING LEFT TURN			# LANES			OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	RT	VOLUME
EASTBOUND	73	681	9	100	100	100	0	2	0	763
WESTBOUND	98	511	80	100	100	0	0	1	1	511
NORTHBOUND	100	70	228	100	100	0	0	1	1	70
SOUTHBOUND	68	18	176	100	100	100	1	1	0	193

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.817	1471
EB	RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.850	1.000	1530
WB	LT-TH-RT	1800	2	1.000	1.000	1.000	1.000	1.000	1.000	0.998	0.879	3158
NB	LT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.908	1635

NB	TH-RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.864	1.000	1555
SB	LT-TH	180[illegible]	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.729	1313
SB	RT	1800	1	1.000	1.000	1.000	1.000	1.000	1.000	0.850	1.000	1530

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	65	48	1	609	591	98	0.16	2	763	0.10
WB	65	48	2	763	763	73	0.10	1	511	0.16
NB	65	11	1	68	193	68	1.00	1	70	0.59
SB	65	11	1	170	298	100	0.59	1	193	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	3221	0.237	42.388	0.398	0.161	5.359	0.839	3.914	2.827	0.817	0.817
WB	1392	0.367	37.732	0.556	0.276	10.015	0.724	4.202	2.025	0.757	0.879
NB	1396	0.050	8.416	0.831	1.000	2.837	0.000	0.000	1.353	0.908	0.908
SB	1800	0.107	4.786	0.754	0.588	6.467	0.412	1.321	1.492	0.729	0.729

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	609	1471	0.41	0.73	1080	0.56	*
EB	RT	80	1530	0.05	0.73	1124	0.07	
WB	LT-TH-RT	802	3158	0.25	0.73	2320	0.35	
NB	LT	68	1635	0.04	0.17	283	0.24	
NB	TH-RT	193	1555	0.12	0.17	269	0.72	
SB	LT-TH	170	1313	0.13	0.17	227	0.75	
SB	RT	228	1530	0.15	0.17	265	0.86	*

CYCLE= 65.0 LOST= 6.0 SUM V/S CRIT= 0.56 TOTAL V/C= 0.62

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	0.56	0.73	65.0	2.97	1080	0.52	1.00	3.49	A	2.9	
EB	RT	0.07	0.73	65.0	1.84	1124	0.00	1.00	1.84	A	0.4	
WB	LT-TH-RT	0.35	0.73	65.0	2.33	2320	0.04	1.00	2.37	A	3.7	
NB	LT	0.24	0.17	65.0	17.62	283	0.09	1.00	17.71	C	1.0	
NB	TH-RT	0.72	0.17	65.0	19.29	269	6.04	1.00	25.32	D	2.9	
SB	LT-TH	0.75	0.17	65.0	19.40	227	8.59	1.00	27.98	D	2.6	
SB	RT	0.86	0.17	65.0	19.84	265	16.30	1.00	36.14	D	4.0	

DIR	Delay	LOS
EB	3.30	A
WB	2.37	A
NB	23.35	C
SB	32.66	D

INTERSECTION DELAY = 10.82 INTERSECTION LOS=B

THE CYCLE LENGTH WITHIN THE BOUNDS OF 65 TO 65 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 65.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 14.7 SECONDS
for chosen cycle length 65.0
suggested timing phase 1 is 43.4 secs green, 3.0 secs yellow + red clear
suggested timing phase 2 is 15.6 secs green, 3.0 secs yellow + red clear

Brookline Avenue/Deaconess Road Intersection: Proposed Mitigation

CINCH PROGRAM VERSION DATE 4-29-1988
1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
4- BROOKLINE AVE/DEACONESS RD
4- BUILD 98 AM
date:01-18-1994 time:15:25:46
LAST DATA SET NAMES LOADED OR SAVED M= Mitigation
VOLUME=4AM98BM GEOMETRICS=4AM98BM SIGNAL=4AM98BM
LOCATED IN CBD:Y

VOLUME & GEOMETRICS

DIR	VOLUMES LT	TH	RT	# OF LANES LT	TH	RT	LANE WIDTH LT	TH	RT	CROSS WALK
EB	38	11	79	0	1	0	0.0	15.0	0.0	40
WB	34	0	77	0	1	0	0.0	12.0	0.0	40
NB	0	1142	83	0	2	0	0.0	11.0	0.0	60
SB	101	631	0	1	1	0	10.0	15.0	0.0	60

TRAFFIC & ROADWAY CONDITIONS

DIR	GRADE	%HV	ADJ PARK Y/N	PARK MOVES	BUSES	PHF	PEDESTRIANS CROSS	BUT	MIN TIME	ARR TYPE
EB	0.0%	1.0%	N	0	0	.880	73	Y	17.0	3
WB	0.0%	1.0%	N	0	0	.750	138	Y	17.0	3
NB	0.0%	0.2%	Y	0	1	.840	33	Y	22.0	3
SB	0.0%	8.0%	Y	0	1	.840	129	Y	22.0	3

PHASINGS

	EASTBOUND l	t	r	p	WESTBOUND l	t	r	p	NORTHBOUND l	t	r	p	SOUTHBOUND l	t	r	p	GREEN	Y+R	PRE/ACT
1													*				6.8	0	A
2										*	*		*	*			62.4	5	A
3	*	*	*		*		*										20.8	5	A

CYCLE= 100.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV	THV	RTV	PHF	LTFR	THFR	RTFR
EB	38	11	79	.880	43	13	90
WB	34	0	77	.750	45	0	103
NB	0	1142	83	.840	0	1360	99
SB	101	631	0	.840	120	751	0

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH-RT	145	1	1.00	145	0.30	0.62
WB	LT-RT	148	1	1.00	148	0.31	0.69
NB	TH-RT	1458	2	1.05	1531	0.00	0.07
SB	LT	120	1	1.00	120	1.00	0.00
SB	TH	751	1	1.00	751	0.00	0.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES LT	TH	RT	% OPPOSING LEFT TURN LT	TH	RT	# LANES LT	TH	RT	OPPOSING VOLUME
EASTBOUND	45	0	103	100	0	100	0	1	0	103
WESTBOUND	43	13	90	100	100	100	0	1	0	102
SOUTHBOUND	0	1360	99	100	100	100	0	2	0	1399

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH-RT	1800	1	1.100	0.995	1.000	1.000	1.000	0.900	0.807	0.929	1329
WB	LT-RT	1800	1	1.000	0.995	1.000	1.000	1.000	0.900	0.764	0.728	896
NB	TH-RT	1800	2	0.967	0.999	1.000	1.000	0.998	0.900	0.990	1.000	3091
SB	LT	1800	1	0.933	0.962	1.000	1.000	1.000	0.900	1.000	0.950	1381
SB	TH	1800	1	1.100	0.962	1.000	1.000	0.996	0.900	1.000	1.000	1706

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	100	21	1	145	102	43	0.30	1	103	0.31
WB	100	21	1	148	103	45	0.31	1	102	0.30

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
EB	1609	0.064	15.406	0.811	0.297	5.397	0.703	2.906	1.387	0.929	0.929
WB	1614	0.063	15.446	0.811	1.000	5.357	0.000	0.000	1.387	0.728	0.728

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH-RT	145	1329	0.11	0.21	276	0.53	
WB	LT-RT	148	896	0.17	0.21	186	0.79	*
NB	TH-RT	1531	3091	0.50	0.62	1928	0.79	*
SB	LT	120	1381	0.05	0.07	153	0.79	*
SB	TH	751	1706	0.44	0.62	1064	0.71	

CYCLE=100.0 LOST=10.0 SUM V/S CRIT= 0.71 TOTAL V/C= 0.79

FOR THE SOUTHBOUND PROTECTED/PERMISSIVE LEFT TURN LANE THE CAPACITY, V/S AND V/C RATIOS HAVE ALL BEEN ADJUSTED TO REFLECT A CAPACITY FOR 58 LEFT TURNS ON THE CHANGE INTERVAL AND 0 ON THE PERMISSIVE PHASE

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH-RT	0.53	0.21	100.0	26.76	276	1.49	0.85	24.02	C	3.2	
WB	LT-RT	0.79	0.21	100.0	28.55	186	13.83	0.85	36.02	D	3.3	
NB	TH-RT	0.79	0.62	100.0	10.67	1928	1.69	0.85	10.50	B	15.2	
SB	LT	0.79	0.69	100.0	7.92	153	15.46	1.00	23.38	C	3.1	
SB	TH	0.71	0.62	100.0	9.61	1064	1.51	0.85	9.46	B	7.9	

DIR	Delay	LOS
EB	24.02	C
WB	36.02	D
NB	10.50	B
SB	11.38	B

INTERSECTION DELAY = 12.91 INTERSECTION LOS=B

THE CYCLE LENGTH WITHIN THE BOUNDS OF 100 TO 100 SECONDS
WHICH MINIMIZES CRITICAL MOVEMENT DELAY IS 100.0 SECONDS

FOR A V/C RATIO OF .95 THE CYCLE SHOULD BE 40.3 SECONDS
for chosen cycle length 100.0
suggested timing phase 1 is 6.8 secs green, 0.0 secs yellow + red clear
suggested timing phase 2 is 62.4 secs green, 5.0 secs yellow + red clear
suggested timing phase 3 is 20.8 secs green, 5.0 secs yellow + red clear

HMM Associates, Inc.

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